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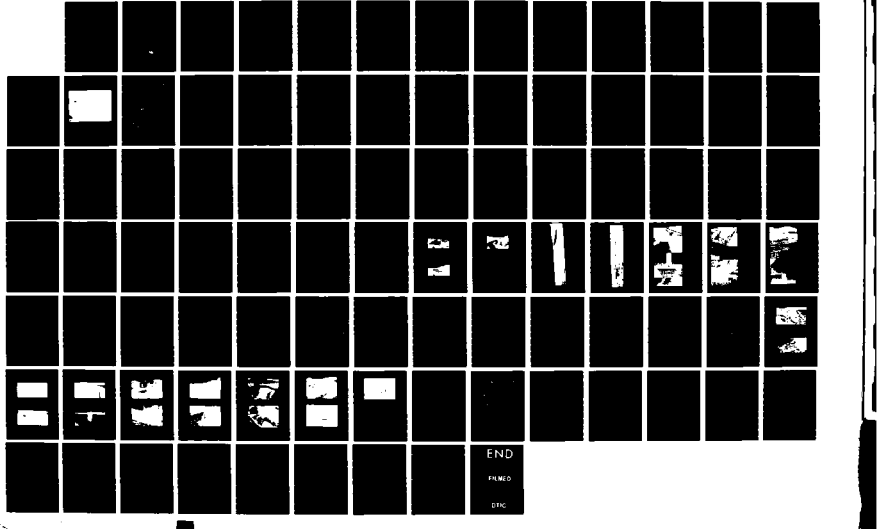

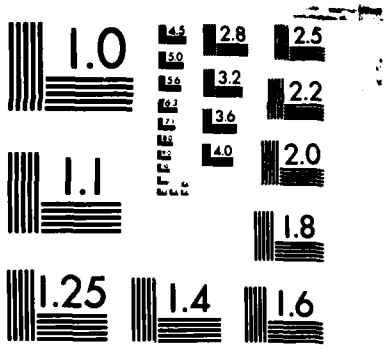


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# NARRAGANSETT BAY BASIN
# PORTSMOUTH, RHODE ISLAND

# LAWTON VALLEY RESERVOIR DAM
# RI 02701



## PHASE 1 INSPECTION REPORT
## NATIONAL DAM INSPECTION PROGRAM







DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

MARCH 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

| REPORT DOCUMENTATION PAGE | | READ INSTRUCTIONS BEFORE COMPLETING FORM |
|---|---|---|
| 1. REPORT NUMBER<br>RI 02701 | 2. GOVT ACCESSION NO.<br>AD A 156 740 | 3. RECIPIENT'S CATALOG NUMBER |
| 4. TITLE (and Subtitle)<br>Lawton Valley Reservoir Dam<br>NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS | | 5. TYPE OF REPORT & PERIOD COVERED<br>INSPECTION REPORT<br>6. PERFORMING ORG. REPORT NUMBER |
| 7. AUTHOR(s)<br>U.S. ARMY CORPS OF ENGINEERS<br>NEW ENGLAND DIVISION | | 8. CONTRACT OR GRANT NUMBER(s) |
| 9. PERFORMING ORGANIZATION NAME AND ADDRESS | | 10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS |
| 11. CONTROLLING OFFICE NAME AND ADDRESS<br>DEPT. OF THE ARMY, CORPS OF ENGINEERS<br>NEW ENGLAND DIVISION, NEDED<br>424 TRAPELO ROAD, WALTHAM, MA. 02254 | | 12. REPORT DATE<br>March 1980<br>13. NUMBER OF PAGES<br>42 |
| 14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) | | 15. SECURITY CLASS. (of this report)<br>UNCLASSIFIED<br>15a. DECLASSIFICATION/DOWNGRADING SCHEDULE |

16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Narragansett Bay Basin
Portsmouth Rhode Island
Lawton Valley Brook

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is about 2630 ft. long and 33 ft. high. The dam is considered to be in good condition. To assure the long term performance of the dam several deficiencies require monitoring or correction.The dam is intermediate in size with a signoficant hazard potential.

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REPLY TO
ATTENTION OF
NEDED

MAY 01 1980

Honorable J. Joseph Garrahy
Governor of the State of Rhode Island
and Providence Plantations
State House
Providence, Rhode Island 02903

Dear Governor Garrahy:

Inclosed is a copy of the Lawton Valley Reservoir Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Management, the cooperating agency for the State of Rhode Island. In addition, a copy of the report has also been furnished the owner, City of Newport, Newport, Rhode Island 02840.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Management for your cooperation in carrying out this program.

Sincerely,

MAX B. SCHEIDER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

LAWTON VALLEY RESERVOIR DAM

RI 02701





NARRAGANSETT BAY BASIN

PORTSMOUTH, RHODE ISLAND

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

| | |
|---|---|
| IDENTIFICATION: | RI 02701 |
| NAME OF DAM: | Lawton Valley Reservoir Dam |
| TOWN: | Portsmouth |
| COUNTY AND STATE: | Newport County, Rhode Island |
| STREAM: | Lawton Valley Brook |
| DATE OF INSPECTION: | November 14, 1979 |

## BRIEF ASSESSMENT

The dam at Lawton Valley Reservoir is approximately 2,630 feet long, 33 feet high with an average crest width of 16 feet. The dam is a zoned earth embankment with a concrete corewall extending to bedrock. Upstream embankment slopes are armored and at a 1V on 3H slope. Downstream slopes are grassed with a berm 6 feet wide at Elev. 100. Above the berm area the slope is 1V on 2H; and below the berm is 1V on 2.75H. The outlet works consists of a concrete intake tower in the reservoir pool, a 30-inch diameter outlet conduit through the embankment and an outlet chamber at the downstream toe of the dam. The spillway is located at the left abutment of the dam and is an uncontrolled, concrete, broad-crested ogee weir, 40 feet wide. Overflow discharges flow downstream through an open trapezoidal concrete channel with a base width of 10 feet and side slopes of 1V on 1H. Withdrawals from the reservoir are pumped to the treatment plant adjacent to the reservoir.

As a result of the visual inspection and the review of the "as-built" drawings, the dam is considered to be in GOOD condition. To assure the long-term performance of this structure, several deficiencies require monitoring or correction. These include: seepage along the downstream toe of the dam, wet spongy turf in the vicinity of the pumping station and severely spalled and deteriorated overflow spillway channel.

This dam is classified as INTERMEDIATE in size and a SIGNIFICANT hazard structure in accordance with the recommended guidelines established by the Corps of Engineers. The test flood adopted for Lawton Valley Reservoir Dam is equal to the full Probable Maximum Flood which is estimated to be 850 CSM or 2450 CFS from the 2.88 square mile drainage basin. This test flood has an outflow discharge equal to 2000 CFS and would not overtop the dam. The maximum spillway capacity, assuming stillwater conditions, is equal to 2000 CFS which is 100 percent of the anticipated test flood outflow.

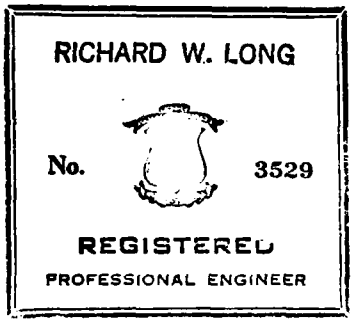
It is recommended that the Owner engage the services of a registered engineer experienced in the design of dams to undertake the following: evaluate and monitor the wet areas along the downstream toe of the dam, particularly the spongy turf in the vicinity of the pumping station, and develop recommendations to control or reduce the seepage, rehabilitate the spalled and deteriorated overflow spillway trapezoidal channel and develop an Emergency Action Plan for critical situations.

Recommendations and remedial measures listed above and detailed in Section 7 should be implemented by the Owner within two years after receipt of this phase 1 inspection report.

CE Maguire, Inc.

By: Richard W. Long

Richard W. Long, P.E.
Vice President



This Phase I Inspection Report on Lawton Valley Reservoir Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

ARAMAST MAHTESIAN, MEMBER
Geotechnical Engineering Branch
Engineering Division

CARNEY M. TERZIAN, MEMBER
Design Branch
Engineering Division

RICHARD DIBUONO, CHAIRMAN
Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

JOE B. FRYAR
Chief, Engineering Division

## PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase 1 Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, DC 20314. The purpose of a Phase 1 Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase 1 investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditons which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of the dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase 1 inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

The Phase 1 Investigation does not include an assessment of the need for fences, gates, no-trespassing signs, repairs to existing fences and railings and other items which may be needed to minimize trespass and provide greater security for the facility and safety to the public. An evaluation of the project for compliance with OSHA rules and regulations is also excluded.

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REPORT

2. Outlet Works - The outlet works consists of a reinforced concrete intake tower at the upstream toe of the dam, a 30-inch concrete conduit through the embankment, and an outlet chamber at the downstream toe. Inspection of the tower was limited to observation from the crest of the dam, only. The gate mechanisms were operating and were reportedly in good working order, and the concrete work above the waterline appeared to be in good condition. Since the outlet conduit and the outlet chamber were through the embankment and underground, they were not accessible for inspection. The 18-inch diameter blow-off pipe leads from the underground outlet chamber to the open channel of the overflow spillway. (See photo C-13.) Leakage and cracks were observed in the 30-inch diameter concrete conduit in 1979 as the result of daily inspections by operating personnel. This was reportedly repaired by concrete lining of the conduit. (See photos C-6, 7)

d. Reservoir Area. The immediate snoreline around Lawton Valley Reservoir is undeveloped, wooded or cultivated farmland. Slopes are flat to moderate and show little evidence of erosion or sloughing. (See overview photo)

e. Downstream Channel. Overflow spillway discharges flow downstream into Lawton Valley Brook which leads to Weaver Cove and the East Passage of Narragansett Bay, a distance of 3,500 feet. The downstream flow area follows the natural valley of this brook which crosses West Main Road (R.I. Route # 114) about 700 feet from the dam and railroad trackage owned by the Conrail Corporation at a distance of 3,500 feet from the dam. The banks of Lawton Valley Brook are wooded and the alignment is relatively straight leading to the Bay.

## 3.2 Evaluation

Based on the visual inspection, the dam appears to be in good condition; however, the inspection disclosed the following items which require attention.

a. Erosion has occurred along the upstream edge of the crest in several locations.

b. The upstream edge of the foundation for the concrete pad on the upstream slope has been undermined.

c. Brush is growing on the upstream slope between Sta 21+00 and the right abutment.

3. Downstream Slope - The downstream slope is grass-covered and is in good condition. The downstream slope has a mid-slope berm from about Sta 3+00 to Sta 14+00. Stone-lined drainage ditches channel runoff from the mid-slope berm to a stone-lined drainage ditch at the downstream toe.

Most of the area downstream from the toe of the dam between the pump house (approximately Sta 7+00) and the right abutment was wet and soggy with standing water in many locations. Water was flowing in the drainage ditch located at the downstream toe of the dam. (See photos C-3, 4)

Occasional light showers were occurring at the time of the inspection, and it had rained for the last few days prior to the inspection. The area downstream from the toe between the pump house and right abutment is a topographic low bounded by the dam embankment on the east and a raised roadway to the west and collects runoff from the dam embankment. Thus, it was not possible to determine if any of the wet areas downstream from the toe were due to seepage or the result of surface runoff. (See photo C-15)

A few minor erosion features were observed on the downstream slope; but overall, erosion on the slope is minimal. Animal burrows were observed in the slope at Sta 7+00 and 20+00. Several small trees (less than 1 foot in diameter) are growing at the downstream toe between Sta 21+50 and Sta 23+00. (See photo C-14)

c. Appurtenant Structures.

1. Spillway - The upstream spillway channel is unlined, and there is some brush growing in the floor of the channel. The spillway weir and training walls are concrete. The downstream spillway channel consists of a concrete lined sluiceway. The concrete lining of the sluiceway is spalled badly in several locations, and small brush is growing in the seams. Weep holes are located in the sluiceway walls; none were discharging at the time of inspection. A number of depressions were observed in the soil, averaging 2 to 4 inches in diameter and up to 6 inches in depth, randomly located behind the sluiceway channel walls. (See photos C-8, 9, 10, 11, 12, 13)

The service bridge across the spillway weir has been removed, and access to the dam during periods when the spillway is in use requires climbing the embankment near the pumping station or driving to the northerly end of the embankment.

## SECTION 3

## VISUAL INSPECTION

### 3.1 Findings

a. General. The Phase 1 inspection of the dam at Lawton Valley Reservoir was performed on 14 November 1979 by representatives of CE Maguire, Inc. and Geotechnical Engineers, Inc. Based on the visual inspection, limited history and general appearance, the dam and its appurtenances are judged to be in GOOD condition.

b. Dam. The dam is an earth embankment with a spillway located at the left abutment. Available plans indicate that the embankment has a concrete corewall keyed into bedrock and a clay core on the upstream side of the corewall.

1. Upstream Slope - The upstream slope is covered with riprap up to the crest. The overall condition of the riprap is good, although some slumping of the riprap has occurred in several locations. Apparent downslope movement of the riprap has exposed the underlying gravel base in some areas. Slumping of the riprap and erosion of the underlying material have occurred along the upstream edge of the crest in several locations. Crushed stone and additional riprap have been placed near the crest on the upstream slope in several locations, apparently to repair areas where slumping and erosion have occurred. (See photos C-1, 2.)

   There is a concrete pad on the upstream slope in the area of the outlet works (approximately Sta. 6+00) which extends outward from the crest towards the reservoir. The upstream edge of the pad foundation has been undermined; however, no evidence of downslope movement of the concrete structure was observed.

   Brush is growing on the upstream slope in a section extending from Sta 21+00 to the right abutment. Maintenance personnel were clearing brush in this area at the time of inspection. There are several small trees (less than 1 foot diameter) at the right abutment.

2. Crest - The crest is grass-covered to the left of Sta 5+50 and is paved with asphalt from Sta 5+50 to the right abutment. The pavement is in good condition and has no significant cracks. (See photo C-5)

## SECTION 2

## ENGINEERING DATA

### 2.1 Design Data

The following documents which contain the principal information available for this dam and its appurtenances were reviewed in the preparation of this report.

Drawings:

1. Federal Works Agency - Water Works Improvements,
   City of Newport, RI - Dam & Appurtenances
   Contract No. 2, Project RI 37-901; May 23, 1942.
   Sheets 1 through 6.
   Designed by Charles A. Maguire & Associates,
   Engineers, Providence, Rhode Island

### 2.2 Construction Data

No record of construction or subsequent repairs is available for this dam. The above referenced drawings are marked as "As-Builts", and are assumed to reflect the existing structures.

### 2.3 Operation Data

The Newport Water Department maintains records of operation of this facility for withdrawals and water surface levels.

### 2.4 Evaluation of Data

a. Availability. The information noted above for this facility is available in the files of the Newport Water Works and the Department of Environmental Management - State of Rhode Island.

b. Adequacy - The lack of in-depth engineering data did not allow for a definitive review. Therefore, the adequacy of this dam could not be assessed from the standpoint of reviewing design and construction data, but is based primarily on visual inspection, past performance and sound engineering judgment.

c. Validity. The validity of the limited data available must be verified.

| | | |
|---|---|---|
| 6. | D/S Channel | Concrete trapezoidal channel with steep slope, 7.7%. |
| 7. | General | Service bridge at weir-removed. |

j. Regulating Outlets

Refer to Paragraph 1.2b, "Description of Dam and Appurtenances", for description of outlet works.

| | | |
|---|---|---|
| 1. | Downstream invert | 71.0 feet |
| 2. | Size | 30-inch diameter conduit through dam. 18-inch diameter blow-off pipe. |
| 3. | Description | 30-inch concrete pipe; 18-inch cast iron pipe. |
| 4. | Control Mechanism | Manually operated sluice gates. |
| 5. | Other | Covered structure with pump-house and force main for water supply. |

| | | |
|---|---|---|
| 2. | Length (including spillway) | 2,630 feet |
| 3. | Height (at toe of Dam) | 33 feet |
| 4. | Top width | 16.0 feet |
| 5. | Side Slopes | 1V on 2H on upstream side; 2H on 1V on downstream side up to Elev. 100; 1V on 1V 2.75H on downstream side below Elev. 100. |
| 6. | Zoning | The enbankment has a concrete core wall, clay zone and selected rolled fill zones of impervious soil materia Upstream shell is armor |
| 7. | Impervious core | Concrete corewall. |
| 8. | Cutoff | Corewall extends 3 feet into bedrock. |
| 9. | Grout curtain | Not indicated on as built drawings. |
| 10. | Other | -- |

h. Diversion and Regulating Tunnel

| | | |
|---|---|---|
| 1. | N/A | |

i. Spillway

| | | |
|---|---|---|
| 1. | Type | Free overflow concrete ogee weir. |
| 2. | Length of weir | 40 feet |
| 3. | Crest elevation | 110.0 feet |
| 4. | Gates | Uncontrolled; (provisio for flash boards exists |
| 5. | U/S Channel | Natural reservoir bed with sloping placed stone apron. |

| | | |
|---|---|---|
| 1. | Normal pool | 3,000 |
| 2. | Flood control pool | N/A |
| 3. | Spillway crest pool | 3,000 |
| 4. | Top of dam | 3,000 |
| 5. | Test flood pool | 3,000 |

e. Storage. (Acre-Feet)

| | | |
|---|---|---|
| 1. | Normal pool | 1,260 |
| 2. | Flood control pool | N/A |
| 3. | Spillway crest | 1,260 |
| 4. | Test flood pool | 1,764 |
| 5. | Top of dam | 1,764 |

6. Net storage between top of dam (Elev. 116.0) and spillway crest is 504 Ac.-Ft. and represents 3.28 inches of runoff from the drainage area of 2.88 square miles.

7. Each foot of surcharge storage from spillway crest to the top of the dam equals 0.55 inches of runoff from the drainage area.

f. Reservoir Surface (acres)

| | | |
|---|---|---|
| 1. | Recreation pool | N/A |
| 2. | Flood control pool | N/A |
| 3. | Spillway crest | 84 |
| 4. | Test flood | 113.0 |
| 5. | Top of dam | 113.0 |

g. Dam.

| | | |
|---|---|---|
| 1. | Type | Earth embankment with concrete corewall. |

recorded as 6 inches of flow over the spillway weir that occurred in February, 1978.

1. Outlet Works

Outlet works conduit size = 18 inch diameter pipe (Blow-off pipe)
Invert Elevation = 71.0 feet

i. Discharge capacity @ Spillway Crest Elev. 110.0 = 56 CFS

ii. Discharge capacity @ Top of Dam Elev. 116.0 = 60 CFS

iii. Discharge capacity @ Test Flood Level Elev. 116.0 = 60 CFS

| | | |
|---|---|---|
| 2. | Maximum known flood at damsite | Unknown |
| 3. | Ungated Spillway Capacity at top of dam | 2,000 CFS |
| 4. | Total Project Discharge at top of dam (Spillway plus outlet discharge) | 2,060 CFS |
| 5. | Total Project discharge at Test Flood Level (Spillway plus Dam Overflow) | 2,000 CFS |

c. Elevations. (Feet above NGVD)

| | | |
|---|---|---|
| 1. | Toe of dam at natural ground (not at streambed) | 85.0 |
| 2. | Bottom of cut-off | Varies |
| 3. | Maximum tailwater | Unknown |
| 4. | Recreation pool | N/A |
| 5. | Full flood control pool | N/A |
| 6. | Spillway crest (ungated) | 110.0 |
| 7. | Design Discharge (original design) | Unknown |
| 8. | Top of Dam | 116.0 |
| 9. | Test flood design surcharge | 116.0 |

d. Reservoir. (Length in feet)

f. Operator. Operating personnel are under the direction of:

Mr. Frederick W. Kent, Jr., Director
Newport Water Department
Halsey Street
Newport, Rhode Island 02840
(401)-847-0154

g. Purpose of Dam. The dam at Lawton Valley Reservoir impounds water from Lawton Valley Brook that is used to augment the supply provided by St. Mary's Reservoir in the Newport Water System.

h. Design and Construction History. This facility was constructed in 1943 for the City of Newport. The dam was designed by Charles A. Maguire & Associates. In 1979, unusual leakage was noted at the toe of the dam and subsequent grouting repair to the 30-inch diameter outlet conduit was completed. No other repair work has occurred at the damsite.

i. Normal Operating Procedure. Lawton Valley Reservoir is operated as a supplemental supply to the Newport Water System. Water is generally withdrawn by gravity from St. Mary's Reservoir for use in the system. During periods of high demand or high reservoir stages that would result in spillage over the spillway, water is withdrawn from Lawton Valley as a supplement to the system. As an average, 4-5 MGD are taken from Lawton Valley in the summer and 2-2.5 MGD during the winter.

## 1.3 Pertinent Data

a. Drainage Area. The Lawton Valley Reservoir watershed, located in Newport County, Rhode Island, is oval in shape with a length of about 17,000 feet, a maximum width of 8,000 feet and a total drainage area of 2.88 square miles. (See Appendix D for Basin Map). Approximately 10 percent or 0.29 square miles of the basin is occupied by natural or manmade storages. The topography is moderately sloped with elevations ranging from a high of 270 feet near Mill Lane to Elev. 110.0 at the spillway. Basin slopes average 0.02 to 0.04 ft./ft. The time of concentration for the watershed is estimated to be approximately 80 minutes, increasing the probability that all surface runoff will peak simultaneously at the reservoir site during a high intensity rainfall event. The storage reservoirs within the watershed, therefore, do little to attenuate peaking at Lawton Valley.

b. Discharge at Damsite. There is no discharge data available for this dam on file with the Newport Water Department. Peak discharge computed at this damsite is equal to 48.0 CFS and was

b. Description of Dam and Appurtenances. The dam at Lawton Valley Reservoir is approximately 2,630 feet long, 33 feet high with an average crest width of 16.0 feet. The dam is a zoned earth embankment with a concrete corewall and cutoff extending to bedrock. Upstream embankment slopes are armored and at a 1V on 3H slope. The downstream slope is grassed with a berm 6.0 feet wide at Elev. 100. Above the berm area the slope is 1V on 2H and below the slope changes to 1V on 2.75H. The outlet works consists of a reinforced concrete intake tower with intake gates at the bottom and mid-height; a 30-inch diameter concrete conduit through the embankment and a concrete outlet chamber at the downstream toe of the dam. The spillway, located at the left abutment of the dam is an uncontrolled, concrete, broad-crested wier, 40 feet wide. Discharges flow along the toe of the westerly end of the embankment through a concrete trapezoidal open channel with a base width of 10 feet and side slopes of 1V on 1H. Spillway discharges flow downstream through culverts beneath Lawton Valley Road and West Main Road and eventually to Weaver Cove and the East Passage of Narragansett Bay.

c. Size Classification. Lawton Valley Reservoir has a capacity at the top of the dam (Elev. 116 NGVD) equal to 1,760 Ac.-Ft. and a height of dam of 33 feet. This dam is classified as INTERMEDIATE in size in accordance with the recommended guidelines of the Corps of Engineers.

d. Hazard Classification. The dam is classified as a SIGNIFICANT hazard structure because its failure may cause the loss of lives and property damage. The failure wave can result in downstream damage to Lawton Valley Road, West Main Road, and railroad trackage owned by the Conrail Corporation. Water depths due to possible failure of the dam may range from 20.0 feet immediately downstream of the dam to 6.0 feet at a distance of 3,500 feet where it joins Narragansett Bay. The failure discharge will cause flooding conditions downstream, high velocities of flow, and carry considerable debris which will cause additional damage on impact. Loss of the dam will also result in damage or complete removal of the pumping station at the toe of the Lawton Valley Dam. If this were to occur, the water supply of the City of Newport would continue to be withdrawn from St. Mary's Reservoir supplemented by Nonquid and H. E. Watson Reservoirs, depending on the demand, however, this loss of Lawton Valley Reservoir could result in serious shortages of water to the overall system.

e. Ownership. The Lawton Valley Reservoir is owned by the City of Newport and operated by the Newport Water Department.

NATIONAL DAM INSPECTION PROGRAM

PHASE 1 - INSPECTION REPORT

LAWTON VALLEY RESERVOIR DAM

## SECTION 1

## PROJECT INFORMATION

### 1.1 General

a. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army through the Corps of Engineers to initiate a national program of dam inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. CE Maguire, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Rhode Island. Authorization and notice to proceed was issued to CE Maguire, Inc., under a letter from Max B. Scheider, Colonel, Corps of Engineers. Contract No. DACW33-80-C-0013 has been assigned by the Corps of Engineers for this work.

b. Purpose.

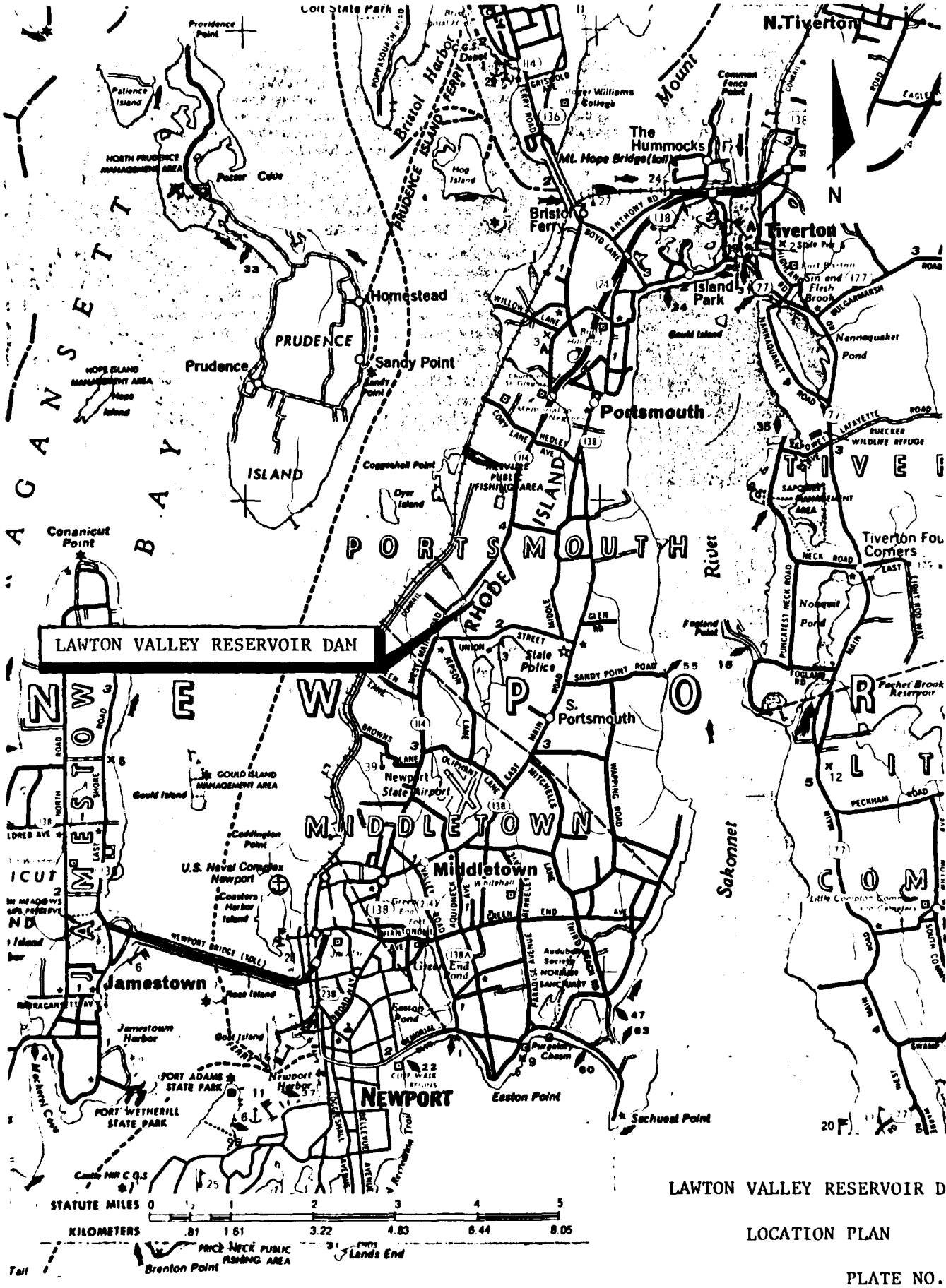
1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and assist the States to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify, and complete the National Inventory of Dams.

### 1.2 Description of Project

a. Location. The dam at Lawton Valley Reservoir is located in the Town of Portsmouth, Newport County, Rhode Island. Coordinates of the dam are approximately 41°-33.9'N Latitude and 71°-16.8' W Longitude. (See Plate No. 1). The dam impounds water from Lawton Valley Brook which drains a 2.8 square mile drainage area of moderately sloped terrain. The dam is approximately 2,630 feet in length, parallel and adjacent to West Main Road and is located about 2,000 feet north of the intersection of Union Street and West Main Road.




LAWTON VALLEY RESERVOIR DAM

LOCATION PLAN

PLATE NO. 1

OVERVIEW PHOTO - LAWTON VALLEY RESERVOIR DAM

## APPENDICES

d. The area downstream from the toe between the pump house and right abutment is wet and soggy with standing water in many locations. The water surface level in the reservoir at the time of inspection was low.

e. Several small trees are growing at the downstream toe between Sta 21+50 and 23+00.

f. Brush is growing in the floor of the upstream spillway channel.

g. The concrete lining of the spillway sluiceway is spalled badly with small brush growing in the joints.

h. A number of depressions have formed in the soil immediately behind the sluiceway channel walls.

## SECTION 4

## OPERATIONAL AND MAINTENANCE PROCEDURES

### 4.1 Operational Procedures

a. General

The Lawton Valley Reservoir is a major supply to the Newport Water System, and its capacity represents approximately 10 percent of the usable capacity of the entire system. Since withdrawals from Lawton Valley require pumping to the adjacent treatment plant, the reservoir is generally regulated as a standby supply to the main source of water in St. Mary's Reservoir. When reserves in St. Mary's are reduced or the demand requires, water is pumped to the treatment facilities from Lawton Valley. As a general rule, Lawton Valley provides 4 to 5 MGD in the high demand summer months and 2 to 2.5 MGD during the less demanding winter period. The gates in the intake tower normally remain open, and regulation of the pool level and withdrawals is controlled by gates at the outlet chamber at the toe of the dam. Levels of the pool and hours of pump operation are recorded daily.

b. Description of Any Warning System in Effect

Impending storms or intense rainfalls are monitored, as a rule, by Water Works operations and maintenance personnel from weather forecasts and the U.S. Weather Service (NOAA). During critical periods of high reservoir levels and approaching intense storm activity, both operating and engineering staff are on call and at the site, as needed.

There is no pre-planned warning system for the failure of the Lawton Valley Reservoir Dam. An Emergency Action Plan must be developed so that operating personnel can notify authorities for mobilization of State or local emergency forces, organize remedial measures to minimize or prevent complete failure when possible, and have an awareness of the locations of supplies, standby equipment, and materials.

### 4.2 Maintenance Procedures

a. General

Maintenance of the dam is the responsibility of the Director of Water Supply for the Newport Water Department. The dam is visited daily, and spot inspections are made. Maintenance

problems are reported and scheduled for slack work periods depending on the seriousness of the deficiency. The embankment at the time of the inspection had recently been cleared of brush growth, and the grass covering trimmed. The facility appeared to be well-maintained.

b. Operating Facilities

All operated equipment is inspected annually or exercised more frequently when withdrawals occur.

## 4.3 Evaluation

Operations and maintenance procedures for this dam and its appurtenances appear to be well-programmed and conducted. Maintenance of the facility is evident. An Emergency Action Plan needs to be formulated and posted to insure proper and expedient action during critical periods.

## SECTION 5

## EVALUATION OF HYDRAULIC/HYDROLOGIC FEATURES

5.1 General. Lawton Valley Reservoir Dam, constructed as a water supply source for the City of Newport, is located on Lawton Valley Brook 3,500 feet upstream of Narragansett Bay. This reservoir has a total drainage area of 2.88 square miles. Basin characteristics of the watershed include moderate to flat slopes and approximately 10 percent of this watershed area is manmade storage areas.

This dam has a spillway length of 40 feet and a surcharge height of 6.0 feet between the top of the dam and the spillway crest. The total length of the dam is 2630 feet. The reservoir has a total storage capacity of 1260 Ac.-Ft. at the spillway crest level (Elev. 110) and can accommodate 8.20 inches of runoff from the drainage area. Each foot of depth in the reservoir above the spillway crest can accommodate 84 Ac.-Ft. of water volume equivalent to 0.55 inches of effective runoff.

Because 504 Ac.-Ft., equivalent to 3.28 inches of runoff, is available in the surcharge storage, this dam is considered basically a small storage facility. The maximum spillway capacity is 2000 CFS which represents 100 percent of the test flood outflow. The dam is considered a high spillage facility. Since the dam is an earth embankment, it is less stable against overtopping due to erosion.

5.2 Design Data. As-built drawings are available for this facility, but no design information. In lieu of existing design data, U.S.G.S. Topographic Maps (Scale 1"=2000') were utilized to develop hydrologic parameters such as drainage areas, reservoir surface areas, basin slopes, time of concentration and other runoff characteristics. Elevation - storage relationships for the reservoir were approximated. Surcharge storage was computed assuming that the surface area remained constant above the spillway crest. Some of the pertinent hydraulic design data was obtained and/or confirmed by actual field measurements at the time of visual field inspection.

Test flood inflow/outflow values and dam failure profiles were determined in accordance with the Corps of Engineers Guidelines. Final values in this report are approximate and are no substitute for actual detailed analysis.

5.3 Experience Data. Water supply withdrawals and water surface elevations are available for this dam. A peak computed flow of 48 CFS which represent 6 inches of flow over the spillway has been recorded in February, 1978. A minimum storage in the pool was recorded on November 9, 1979, when the pool level was at Elev. 101.5 feet or 102 inches below the spillway crest.

5.4 Test Flood Analysis. Recommended guidelines for the Safety Inspection of Dams by the Corps of Engineers were used for selection of the "Test Flood". This dam is classified under those guidelines as a SIGNIFICANT hazard and INTERMEDIATE in size. Guidelines indicate that one-half P.M.F. to the full P.M.F. be used as a range of test flood events for such classification. The watershed has a total drainage area of 2.88 square miles of which 0.30 square miles or 10 percent is covered by storage reservoirs. The drainage area is sparsely populated, largely wooded, and is hilly with rolling terrain. The average basin slope is 0.035 ft./ft. which can be categorized as flat to moderate. The full P.M.F. was calculated to be 850 CSM, equal to 2450 CFS for a drainage area of 2.88 square miles and was adopted as the test flood. Outflow discharges were also developed using Corps of Engineers' criteria for approximate routing. Outflow discharge for the test flood inflow was equal to 2000 CFS. The spillway and outlet rating curves are illustrated in Appendix D. Flood routing calculations were performed assuming initial full reservoir conditions. That is, with pool surface at the spillway crest level.

The spillway capacity os hydraulically adequate to control the "test flood" (Full P.M.F.) and overtopping of the dam would not occur. The inflow and outflow discharge values for this test flood are 2450 CFS and 2000 CFS, respectively. The maximum outflow capacity of the spillway, in a still reservoir, without overtopping of the dam is 2000 CFS which is 100 percent of the test flood overflow discharge. The overtopping potentials for discharges of lesser magnitudes and frequencies are listed in the table at the end of this section.

At the spillway crest level (Elev. 110.0), the capacity of the outlet structure is 56 CFS. It would require 18 hours to lower the reservoir level one foot, assuming a surface area of 82 acres. For the 1260 Ac.-Ft. of available storage below the spillway level, it is estimated that it will require 22 days to drain the reservoir through the existing outlet.

5.5 Dam Failure Analysis. An instantaneous full-depth-partial width breach of 120 feet was assumed to have occurred at this dam, which would result in an unsteady flow phenomenon with one flood wave travelling up into the reservoir to feed another wave travelling downstream into the valley.

The calculated dam failure discharge of 62,860 CFS, assuming the impounded water level is at the top of the dam (Elev. 116.0), will produce an approximate water surface flood wave elevation of 94.0 feet immediately downstream from the dam. This will raise the water surface about 14.0 feet above the depth just prior to failure when the discharge is 2000 CFS. The failure analysis considered the reach extending from the dam to 3,500 feet downstream. Normal uniform flow, following Manning's formulae, will occur approximately

3,500 feet downstream from the dam with a depth of flow equal to 6.0 feet.

On the assumption that the Route 114 (West Main Road) bridge structure, which is located about 800 feet downstream from this site, will withstand the wave impacts, the depth of flow will change very little; but the failure discharge will diminish as the reservoir is emptied and depth decreased. River valley storage and frictional losses will tend to reduce the discharge and flow velocities in the 3,500 feet reach. Water surface elevations due to failure of the dam are computed and are listed in Appendix D.

Probable consequences including the prime impact areas, if the dam were to fail, are also illustrated on the basin map in Appendix D. It is estimated that the maximum depth of flow due to failure of this dam will be 20 feet and the maximum velocity of the failure wave attained will be 50.0 ft./sec.

The failure wave can result in downstream damage of Lawton Valley Road, West Main Road and railroad trackage owned by the Conrail Corporation. The failure discharge will cause flooding conditions downstream, high velocities of flow, and carry considerable debris which will result in additional damage. Loss of the dam will result in damage or complete removal of the pumping station at the toe of the dam. If this were to occur, operation of the Newport Water system could be seriously impaired.

LAWTON VALLEY RESERVOIR DAM

Inflow, Outflow and Surcharge Data

| FREQUENCY IN YEARS | 24-HOUR TOTAL RAINFALL IN INCHES | 24-HOUR* EFFECTIVE RAINFALL IN INCHES | MAXIMUM INFLOW IN C.F.S. | MAXIMUM** OUTFLOW IN C.F.S. | SURCHARGE HEIGHT IN FEET | SURCHARGE STORAGE ELEVATION |
|---|---|---|---|---|---|---|
| ½ PMF | 11.9 | 9.5 | 1250 | 981 | 3.73 | 113.73 |
| Test Flood = PMF | 21.4 | 19.0 | 2450 | 2000 | 6.00 | 116.0 |

* Infiltration assumed as 0.1"/hour
** Lake assumed initially full at spillway crest elevation 110.0
(top of dam = 116.0 )

NOTES:

1. ½ PMF and "test flood" computation based on the Corps of Engineers instructions and guidelines.

2. The maximum capacity of the spillway without overtopping the dam is equal to 2000 CFS.

3. All discharges indicated are dependent upon the continued integrity of upstream storage reservoirs.

4. Surcharge storage is allowed to overtop the dam when exceeding the spillway capacity.

5. Test flood = full PMF = 850 CSM = 2450 CFS
(D.A. = 2.88 square miles).

## SECTION 6

## EVALUATION OF STRUCTURAL STABILITY

6.1 Visual Observation. The visual observations did not disclose any evidence of present structural instability.

6.2 Design and Construction Data. The available design and construction data is not sufficient to permit a formal stability analysis.

6.3 Post-Construction Changes

No information on post-construction changes is available, if any.

6.4 Seismic Stability

Lawton Valley Reservoir Dam is located in Seismic Zone 1 and in accordance with the recommended Phase I guidelines does not warrant seismic stability analysis.

## SECTION 7

## ASSESSMENT, RECOMMENDATIONS & REMEDIAL MEASURES

### 7.1 Dam Assessment

a. Condition. Based on the visual inspection and a review of available data, the dam is judged to be in GOOD condition. However, there are some features which should be corrected, as recommended in Sections 7.2 and 7.3.

b. Adequacy of Information. An assessment of safety of the dam is based solely on the visual inspection and limited design information which is not sufficient to analyze fully the condition of the dam.

c. Urgency. The recommendations and remedial measures presented below should be implemented by the owner within 2 years after receipt of this Phase I inspection report.

### 7.2 Recommendations

The following recommendations should be carried out under the direction of a qualified registered engineer:

a. Investigate the significance of the wet area downstream of the dam to the right of the pumphouse and the suspect wet areas along the downstream toe, and recommend measures for monitoring and/or preventing possible piping and erosion problems.

b. Evaluate the condition of the open channel spillway surfaces and joints and develop a program for its rehabilitation.

The Owner should implement any recommendations resulting from the above investigations.

### 7.3 Remedial Measures

a. Operations and Maintenance Procedures.

1. The erosion and slumping of riprap that have occurred on the upstream slope should be repaired.

2. The undermining of the upstream edge of the concrete pad on the upstream slope should be repaired.

3. The brush growing on the upstream slope between Sta 21+00 and the right abutment should be cleared.

4. Maintain clear of trees and brush the area within 20 feet of the downstream toe.

5. The small trees growing at the downstream toe between Sta 21+50 and 23+00 should be removed.

6. The brush growing in the floor of the upstream spillway channel should be cleared.

7. The depressions in the soil immediately behind the sluiceway channel walls should be filled.

8. Continue the technical inspection of the dam on an annual basis.

9. Fill in animal burrows.

10. Develop an "Emergency Action Plan" that will include an effective preplanned warning system, reduction of inflow, action to be taken at other reservoirs within the system, locations of emergency equipment, material and manpower, authorities to be contacted, potential areas that require evacuations and reservoir dewatering procedures, The Owner should also provide surveillance of the dam during intense rainfalls.

## 7.4 Alternatives.

There are no recommended alternatives to the above recommendations.

# APPENDIX A

INSPECTION CHECKLIST

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

)JECT Lawton Valley Reservoir Dam DATE November 14, 1979

TIME 9:00 A.M.

WEATHER Cool, overcast, showers

W.S.ELEV. _____ U.S. _____ D.S.

RTY:

A. Reed, CEM
E. Dessert, CEM
L. Topp, CEM
S. Khanna, CEM
R. Murdock, GEI
6. D. Shields, GEI
7.
8.
9.
10.

| PROJECT FEATURE | INSPECTED BY | REMARKS |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

PERIODIC INSPECTION CHECK LIST

OJECT Lawton Valley Reservoir Dam DATE November 14,1979

SPECTOR _____ DISCIPLINE _____

SPECTOR _____ DISCIPLINE _____

| AREA EVALUATED | CONDITION |
|---|---|
| AM EMBANKMENT | |
| Crest Elevation | 116.0 |
| Current Pool Elevation | 102.7 MSL |
| Maximum Impoundment to Date | Unknown |
| Surface Cracks | None observed |
| Pavement Condition | Good |
| Movement or Settlement of Crest | None observed |
| Lateral Movement | None observed |
| Vertical Alignment | Good |
| Horizontal Alignment | Good |
| Condition at Abutment and at Concrete Structures | Good |
| Indications of Movement of Structural Items on Slopes | None observed |
| Trespassing on Slopes | No signs of trespassing |
| Sloughing or Erosion of Slopes or Abutments | Some minor erosion on upstream slope near crest |
| Rock Slope Protection - Riprap Failures | Generally good condition; some minor slumping of riprap, particularly near crest |
| Unusual Movement or Cracking at or Near Toe | None observed |
| Unusual Embankment or Downstream Seepage | Not possible to determine at time of inspection due to weather conditions (see text) |
| Piping or Boils | None observed |

PERIODIC INSPECTION CHECK LIST

JECT Lawton Valley Reservoir Dam DATE November 14, 1979

'ECTOR _____ DISCIPLINE _____

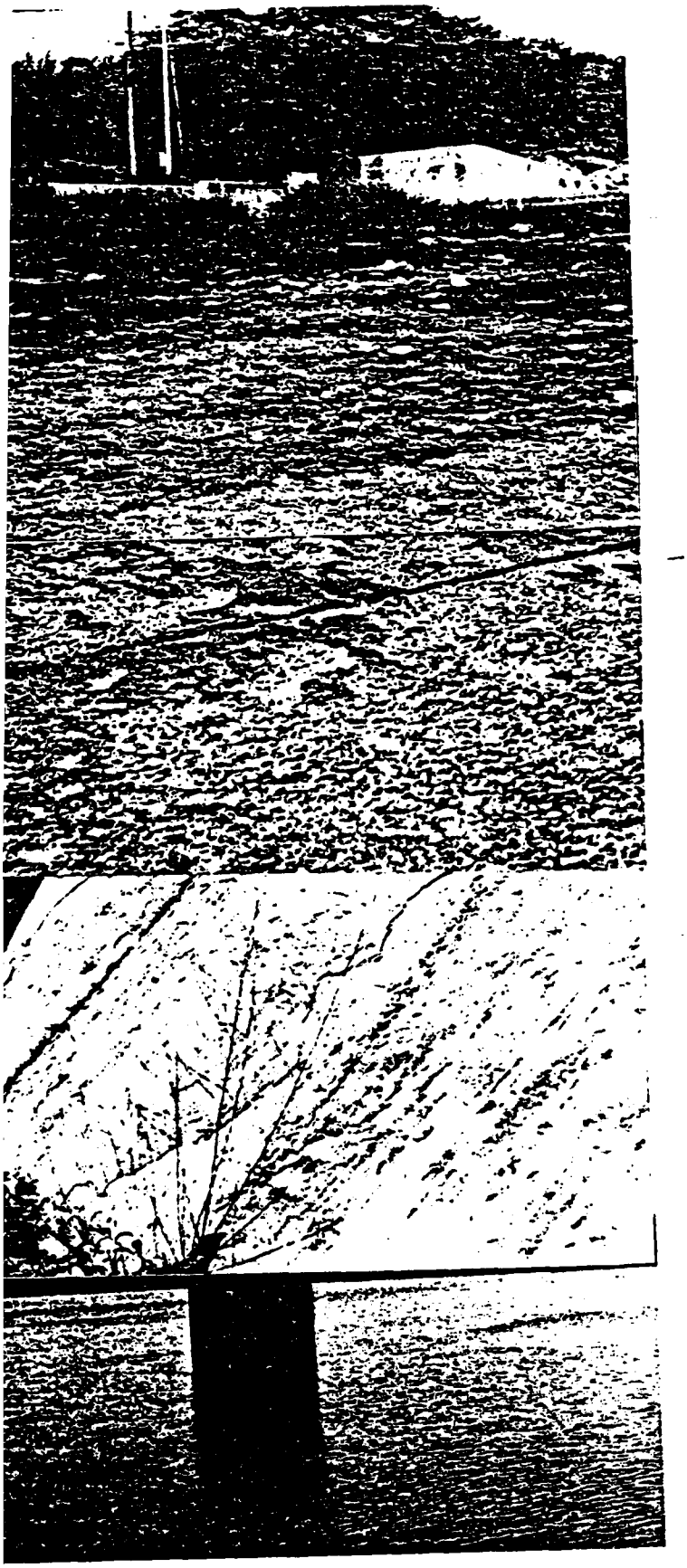
'ECTOR _____ DISCIPLINE _____

| AREA EVALUATED | CONDITION |
|---|---|
| EMBANKMENT (Cont.) | |
| Foundation Drainage Features | None |
| Toe Drains | None |
| Instrumentation System | None |
| Vegetation | Some brush on upstream slope near left abutment and several small trees at downstream toe |

SEPT. 25, 1978

SUPPLEMENTAL PHOTOS

(taken Sept. 25,'78)



DAM #395
LAWTON VALLEY RES.

PHOTOS #6 & 7. Close-up views of severely scoured and spalled conditions on walls of spillway discharge sluiceway.

PHOTO #8. Temporary patch in wall @ lower curve in sluiceway (adjacent to pumphouse).

PHOTO #9. Close-up of scoured condition on floor of spillway. This is one of many similar areas along entire sluiceway.

DAM #395
LAWTON VALLEY RES.

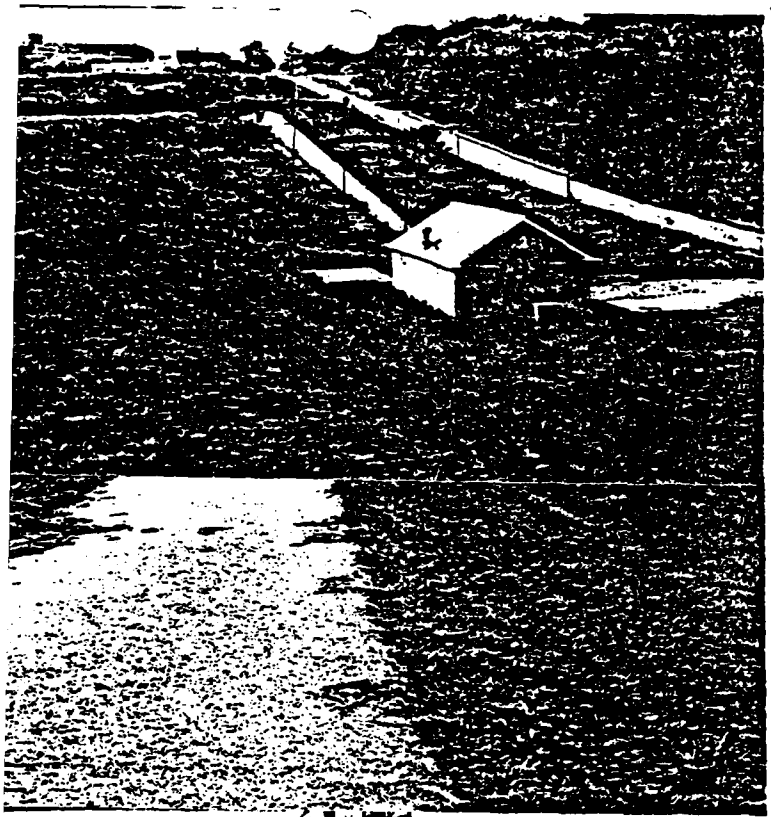


PHOTO #1. General view of downstream side of dam embankment, looking southerly. Pumphouse in foreground and discharge sluiceway in center.

PHOTO #2. General view of dam embankment, looking southerly from northern end of embankment

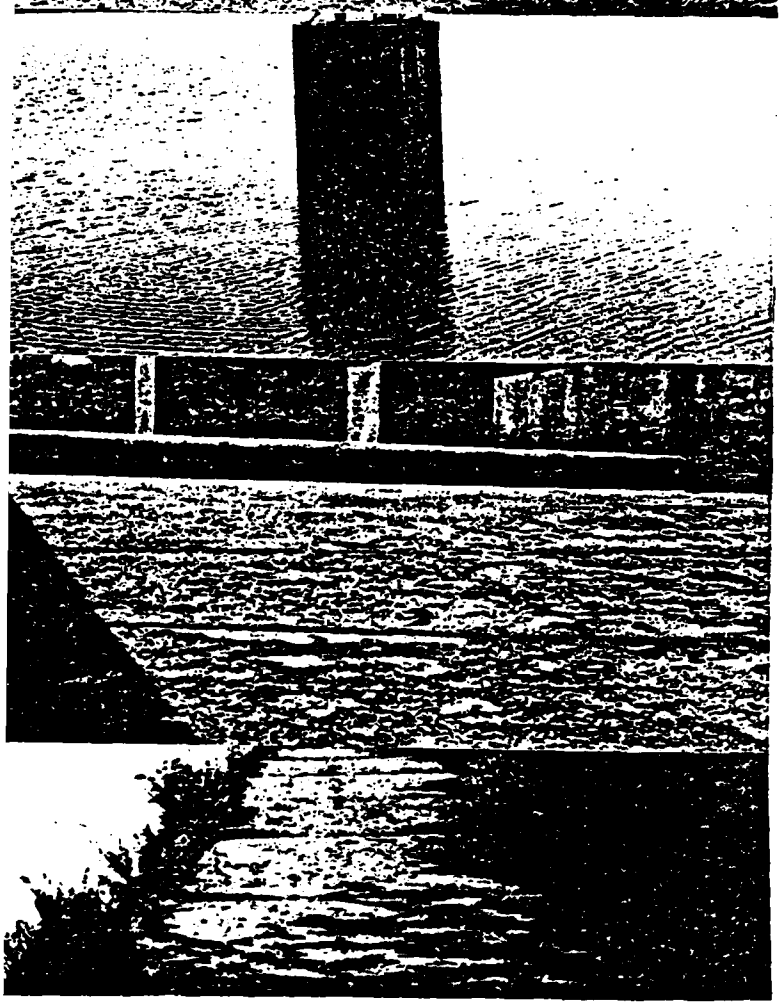
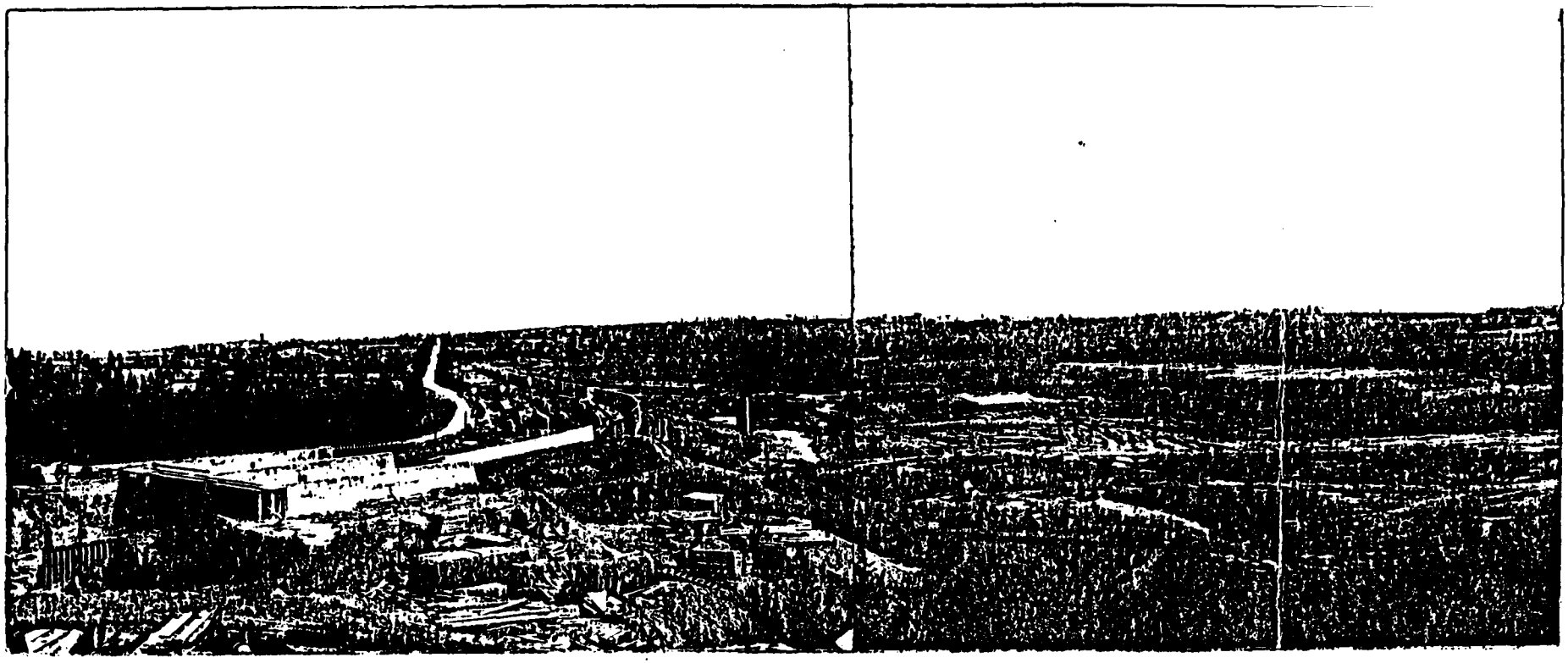


PHOTO #3. Concrete intake control structure. Water level in reservoir currently very low.

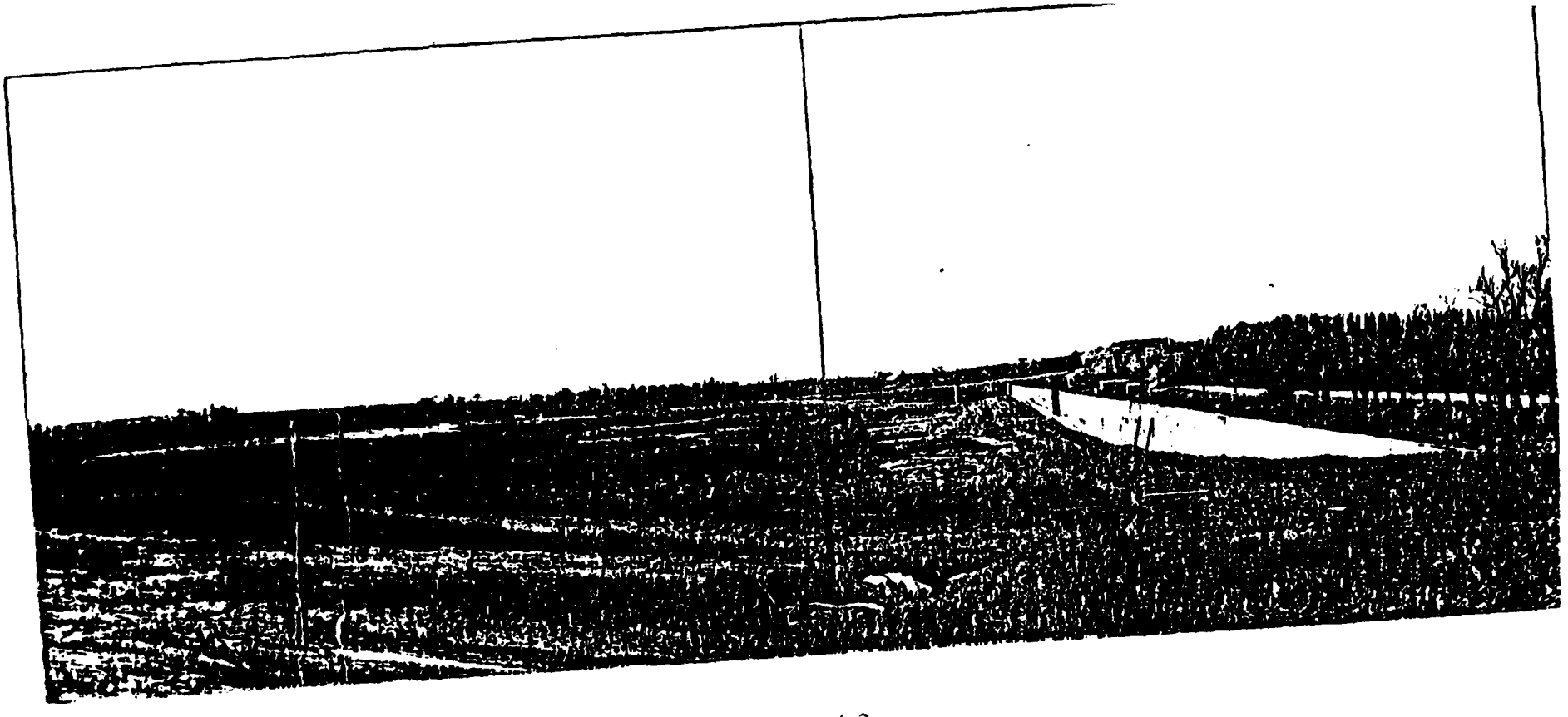
PHOTO #4. View of spillway from downstream side.

PHOTO #5. Looking downstream in concrete discharge sluiceway from spillway.

DAM #395
Lawton Valley Re

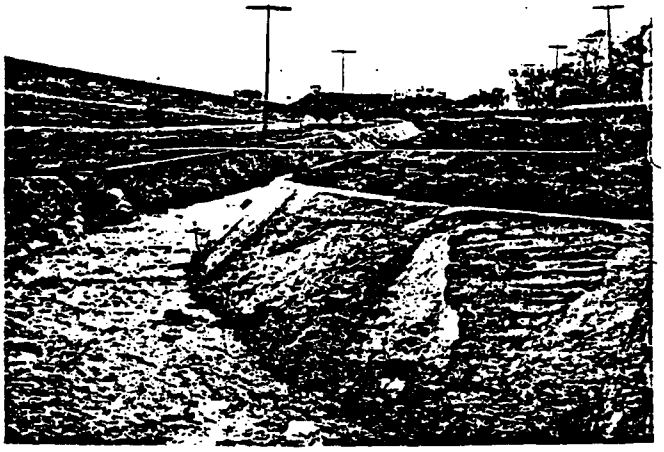


looking north May, 13, 1943



Looking south May 13, 1943

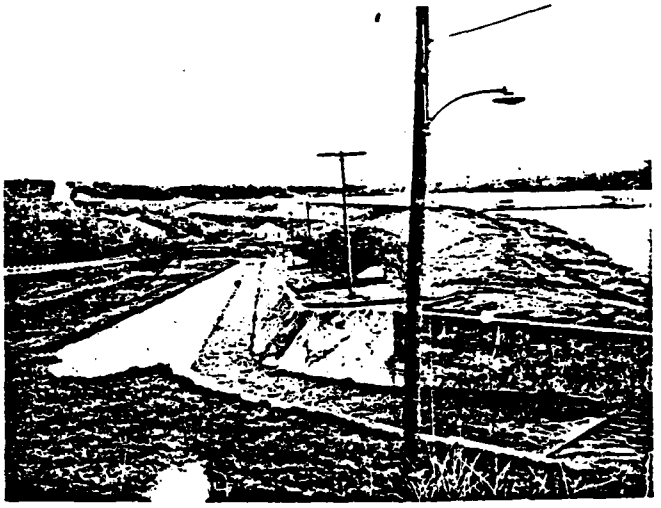
MAY 1973



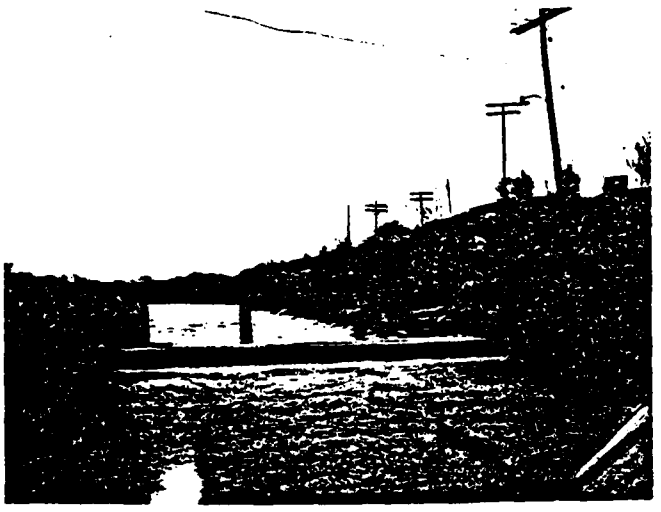
VIEW LOOKING SOUTH UP OUTLET CHANNEL.

NOTE: SPALLING CONCRETE AND VEGETATION IN SEAMS.

MAY 1973



1. GENERAL VIEW OF DAM -- LOOKING NORTH DOWN OUTLET CHANNEL. NOTE SPILLWAY AT RIGHT.



2. VIEW OF CONCRETE SPILLWAY. COMPARE SIZE TO MYSTERIOUS FIGURE ATOP ABUTMENT AT RIGHT.

DEPARTMENT OF NATURAL RESOURCES

DAM INSPECTION REPORT

DAM: #395 RIVER: Lawton Brook WATERSHED: Coastal - Narragansett Bay

NAME: Lawton Valley Reservoir TOWN: Portsmouth

OWNER: Newport Water Dept.
Halsey Street
Newport, RI

c/o Mr. Kent (Main Office)
Phone: 847-0154
Mr. B. Wolfenden
(at the dam)

REPORT ON: General Condition of Dam

REASON FOR INSPECTION: Request by USCOLD for report on any dam over 45 ft. in height

INSPECTION BY: P. Janaros
W. Brinson

DATE OF INSPECTION: 2 May 73

REPORT: This rolled-earth embankment dam is continuously maintained, and is in excellent condition. Some small brush is growing on the rip-rapped pond side of the embankment. This condition is not likely to create leakage, as the dam has a concrete core.

Little or no seepage was observed. The toe-drain did have water init, but it was oily, which would indicate its source to be runoff from a nearby paved road.

The concrete spillway is in excellent condition. However, the concrete-lined outlet channel shows evidence of spalling and some vegetative growth along seams (see attached photograph #3)

## APPENDIX B-2

Selected Copies of Past Inspection Reports

APPENDIX B-1

1. Design, Construction and Maintenance Records and Locations

a. Contract Documents, Correspondence operational records

Newport Water Department
Halsey Street
Newport, Rhode Island 02840

b. Inspection Reports

Department of Environmental Management
State of Rhode Island
83 Park Street
Providence, Rhode Island 02903

# APPENDIX B

## ENGINEERING DATA

PERIODIC INSPECTION CHECK LIST

PROJECT Lawton Valley Reservoir Dam DATE November 14, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

| AREA EVALUATED | CONDITION |
|---|---|
| OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS | |
| a. Approach Channel | Natural bed of reservoir |
| General Condition | Good |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | None |
| Floor of Approach Channel | Unlined; some brush growing in channel floor |
| b. Weir and Training Walls | |
| General Condition of Concrete | Good |
| Rust or Staining | None |
| Spalling | Minor spalling of weir structure |
| Any Visible Reinforcing | None |
| Any Seepage or Efflorescence | None |
| Drain Holes | Weep holes in walls; not discharging at time of inspection |
| c. Discharge Channel | Concrete-lined sluiceway |
| General Condition | Concrete badly spalled in some areas |
| Loose Rock Overhanging Channel | None |
| Trees Overhanging Channel | None |
| Floor of Channel | Concrete-lined; concrete badly spalled in some areas |
| Other Obstructions | None |
| d. Access Bridge | Removed from weir structure; access to dam at north end of embankment or up downstream slope |

PERIODIC INSPECTION CHECK LIST

PROJECT Lawton Valley Reservoir Dam DATE November 14, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

| AREA EVALUATED | CONDITION |
|---|---|
| OUTLET WORKS - OUTLET STRUCTURE AND OUTLET CHANNEL | Closed system - not observable<br><br>30 inch diameter concrete conduit through dam and outlet chamber at toe of dam |

PERIODIC INSPECTION CHECK LIST

PROJECT Lawton Valley Reservoir Dam DATE November 14, 1979

INSPECTOR _____ DISCIPLINE _____

INSPECTOR _____ DISCIPLINE _____

| AREA EVALUATED | CONDITION |
|---|---|
| OUTLET WORKS - INTAKE CHANNEL AND INTAKE STRUCTURE | Not visible (underwater) |
| Intake Tower | Reinforced concrete with interior chamber 8.0 feet square. Gates at Elev. 72.0, 79.25 and 89.25. All gates are manually operated from operation platform, Elev. 116.0, and are 30" x 30" sluice gates. Steel ladder mounted on north side is used for access to tower. |

R. I. DEPARTMENT OF PUBLIC WORKS
DIVISION OF HARBORS AND RIVERS

DAM NO. 395

# SPECIAL INSPECTION REPORT

INSPECTED BY

TOWN OF PORTSMOUTH

DAM NO 395 NAME LAWTON VALLEY DAM ON BROOK / RIVER LAWTON VALLEY / TRENCH WATERSHED NRB

OWNER CITY OF NEWPORT

ADDRESS

REPORT ON—NEW CONSTRUCTION REPAIRS INSPECTION ONLY

PLANS BY APPROVED CONTRACTOR

INSPECTION REPORT BY REASON DATE 2/16/73

TICKLER

SPILLWAY

TYPE

CONDITION

DRAW-OFF GATES

NUMBER

CONDITION

TRENCHES & WHEELS

EMBANKMENT

YPE

CONDITION

APPROACHES

EROSION

BRUSHES & TREES

RIPRAP

PRESENT USE

WHO CONTROLS

WHO CONTACTED AT SITE

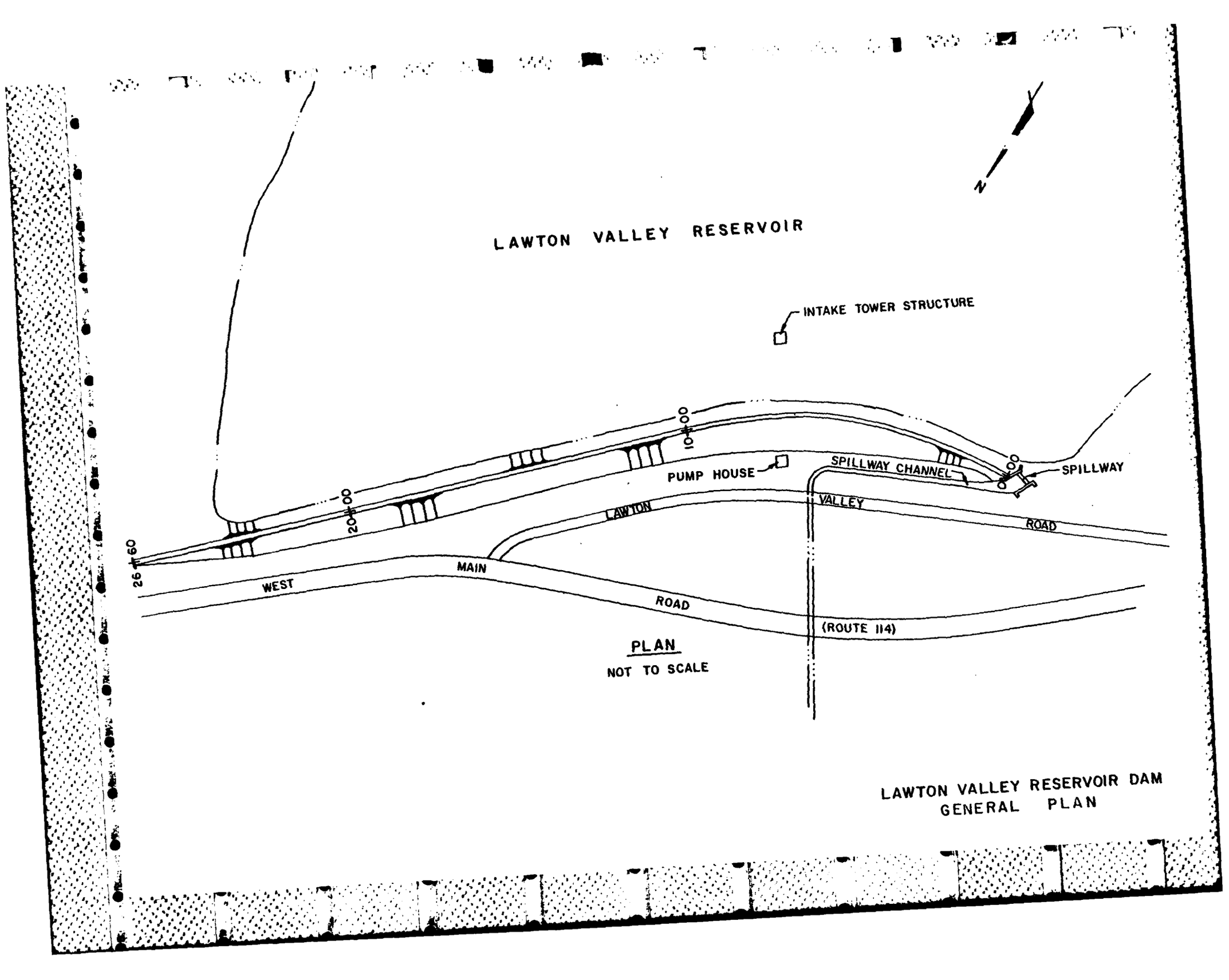
INSTRUCTIONS LEFT

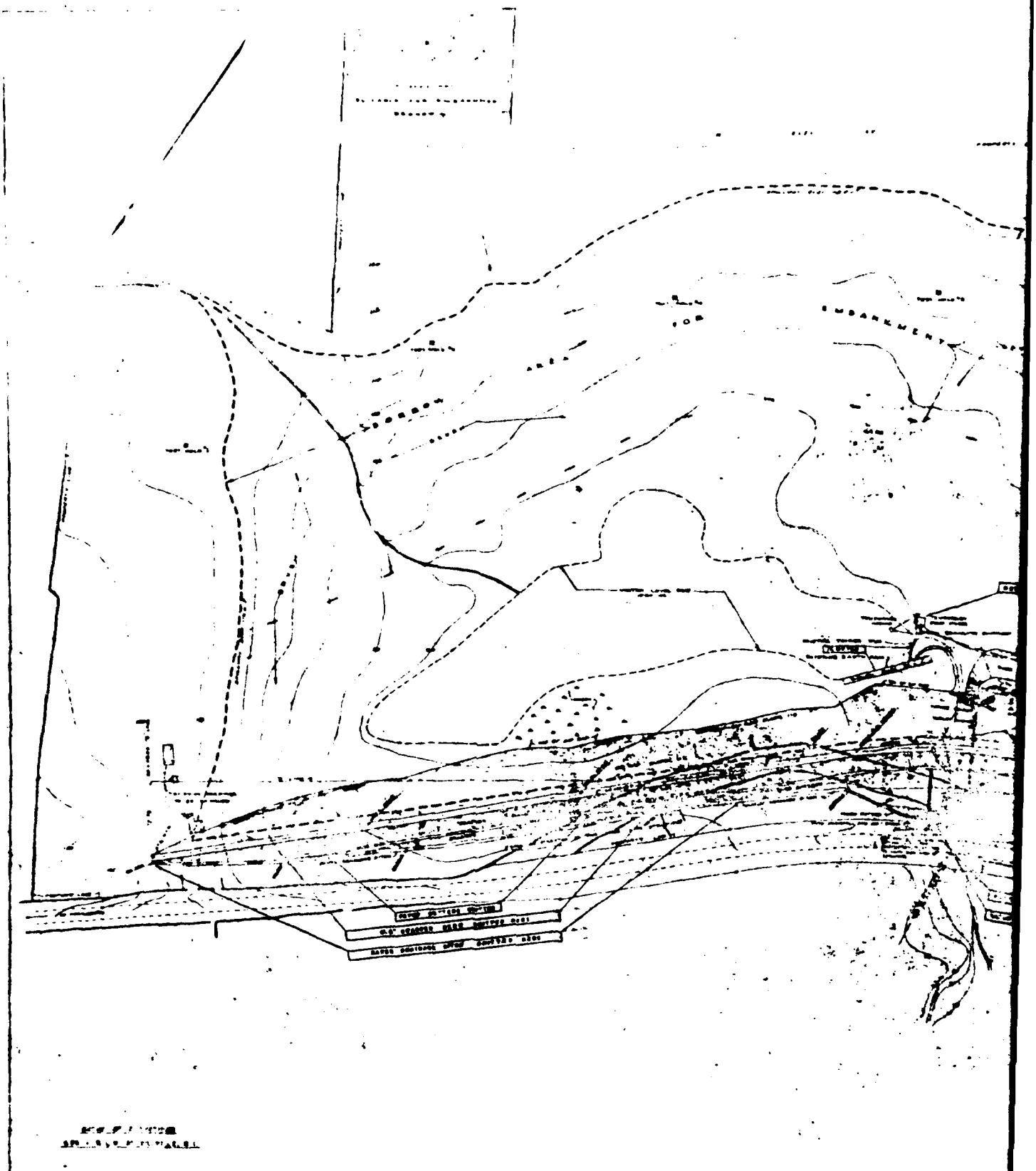
IN EMERGENCY CALL

SOME SPALLING ON CONCRETE LINING OF SPILLWAY, UNABLE TO SEE SOME VEGETATION FOUND GROWING IN CONCRETE LINING

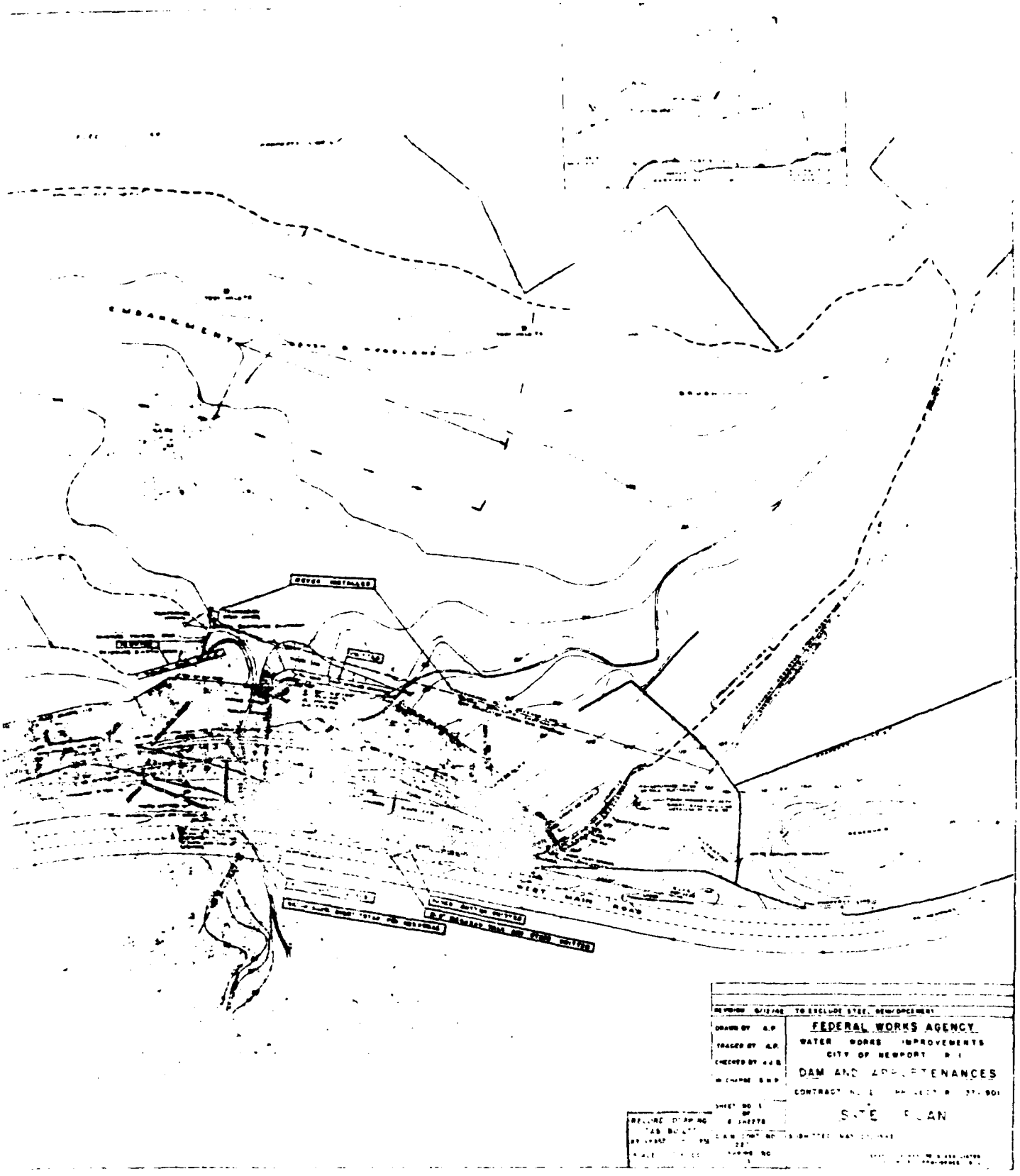
# APPENDIX B-3

PLANS, SECTIONS DETAILS

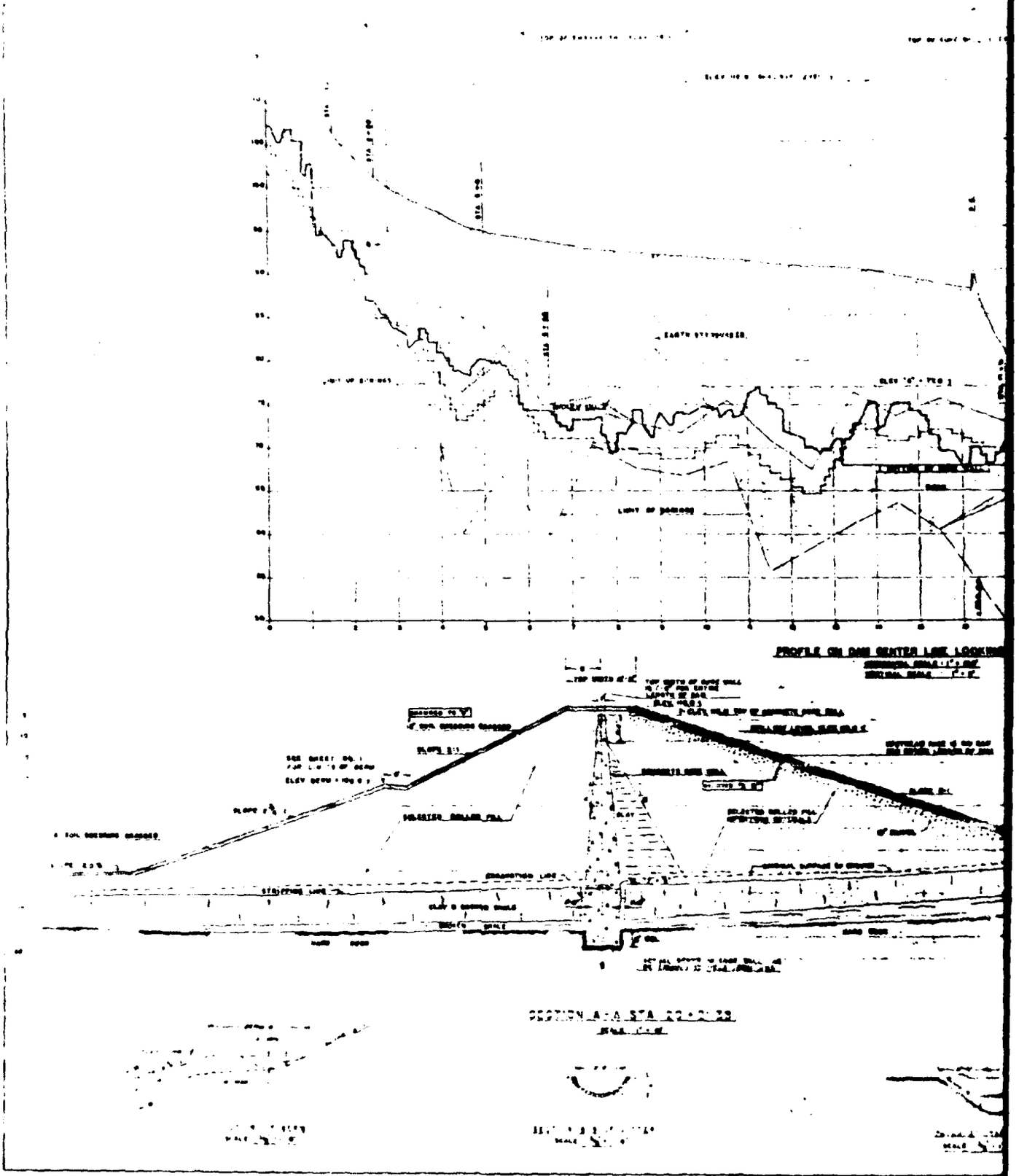

LAWTON VALLEY RESERVOIR
INTAKE TOWER STRUCTURE
PUMP HOUSE
SPILLWAY CHANNEL
SPILLWAY
LAWTON
VALLEY
ROAD
MAIN
WEST
ROAD
(ROUTE 114)
PLAN
NOT TO SCALE
LAWTON VALLEY RESERVOIR DAM
GENERAL PLAN



DR. #1 1 of 2

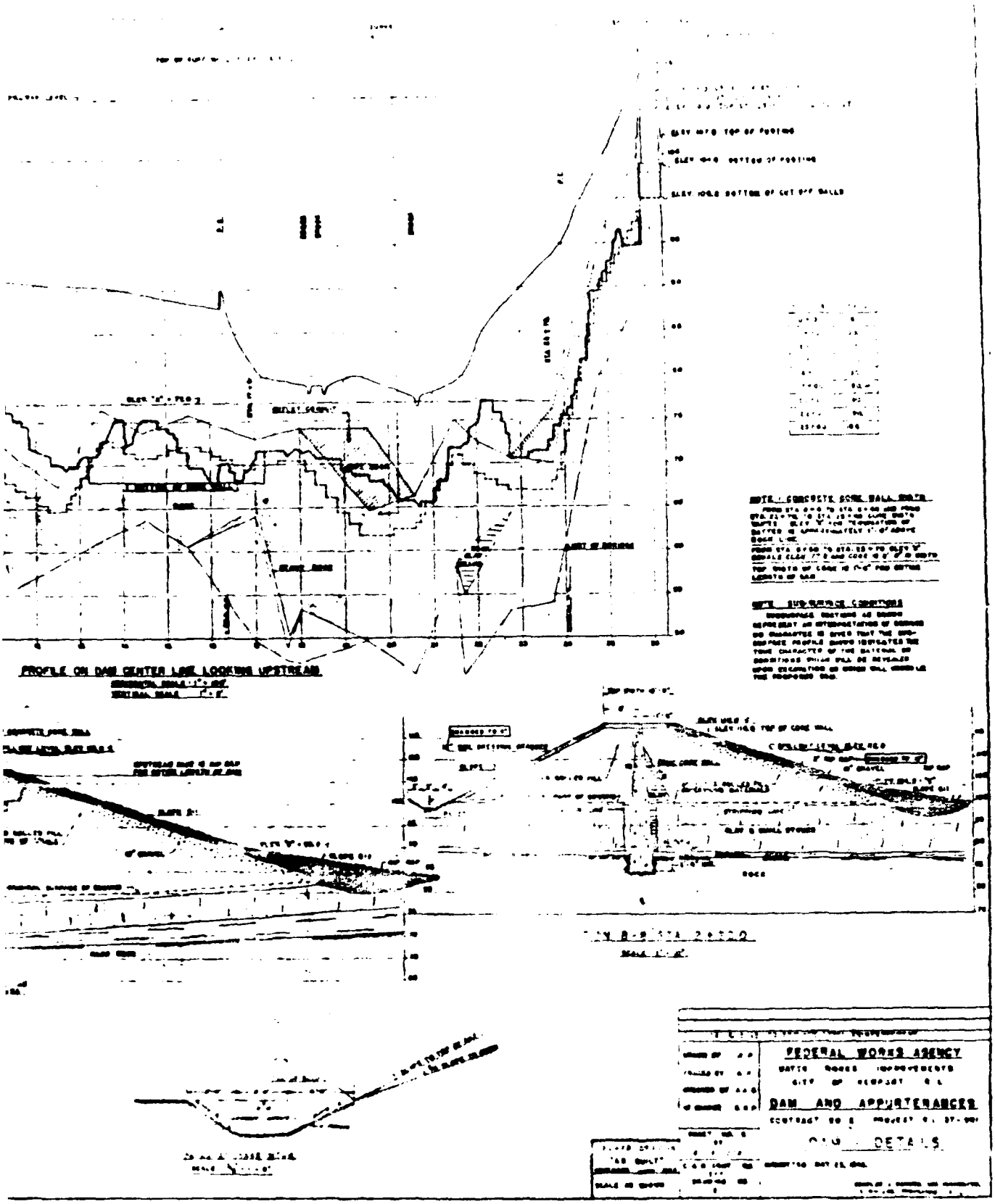



2 of 2

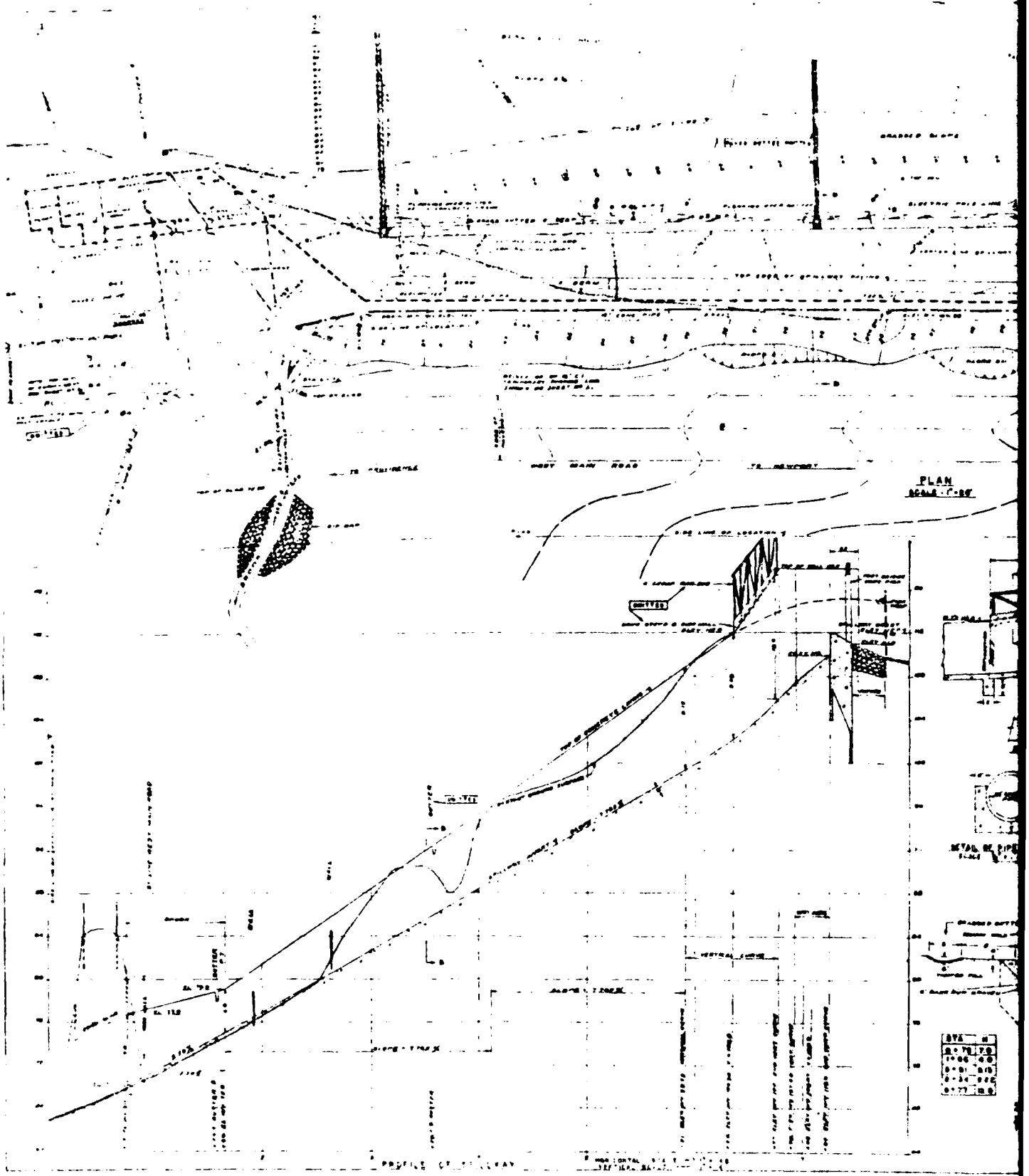


DR. #2

1 of 2

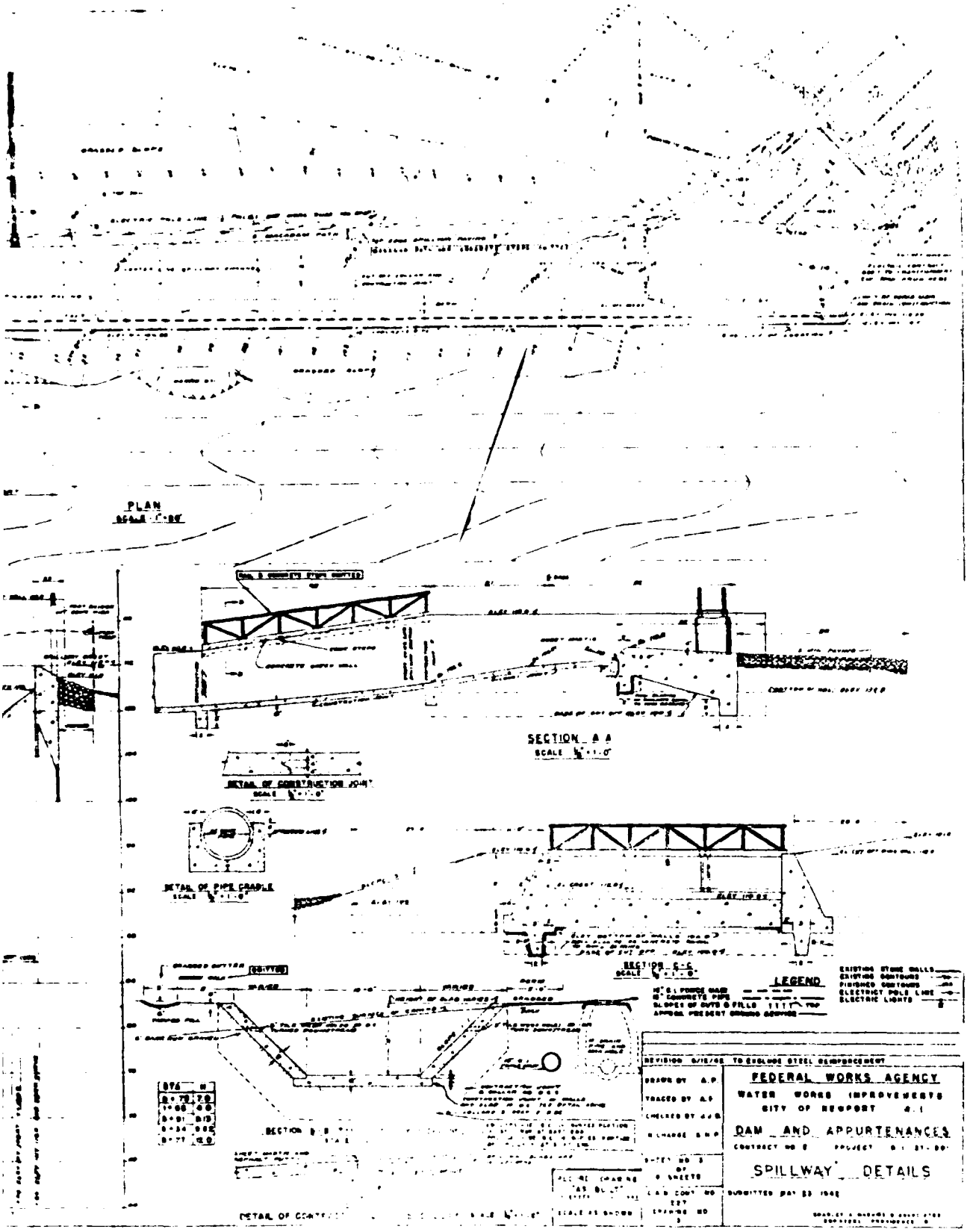


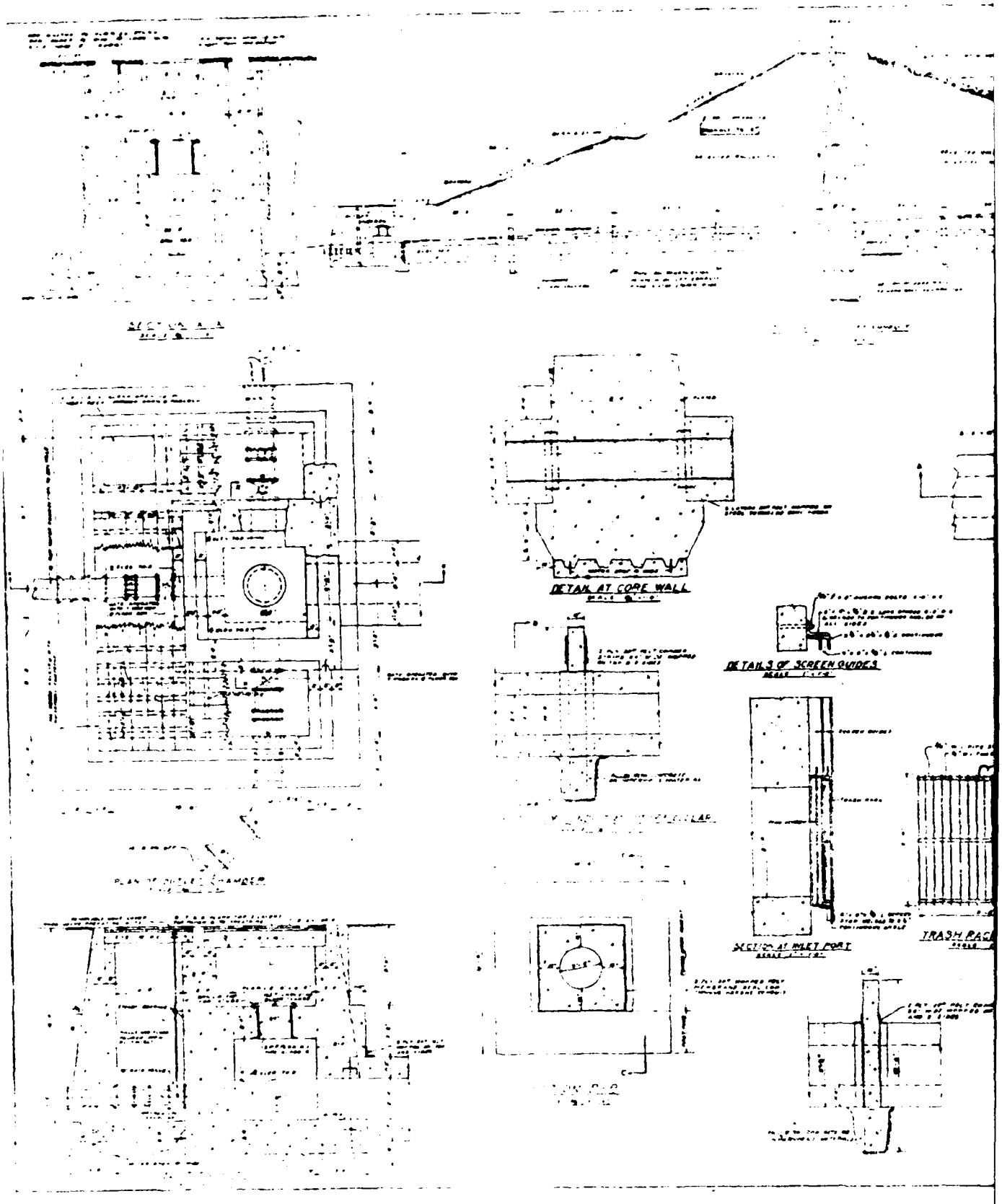

2 of 2



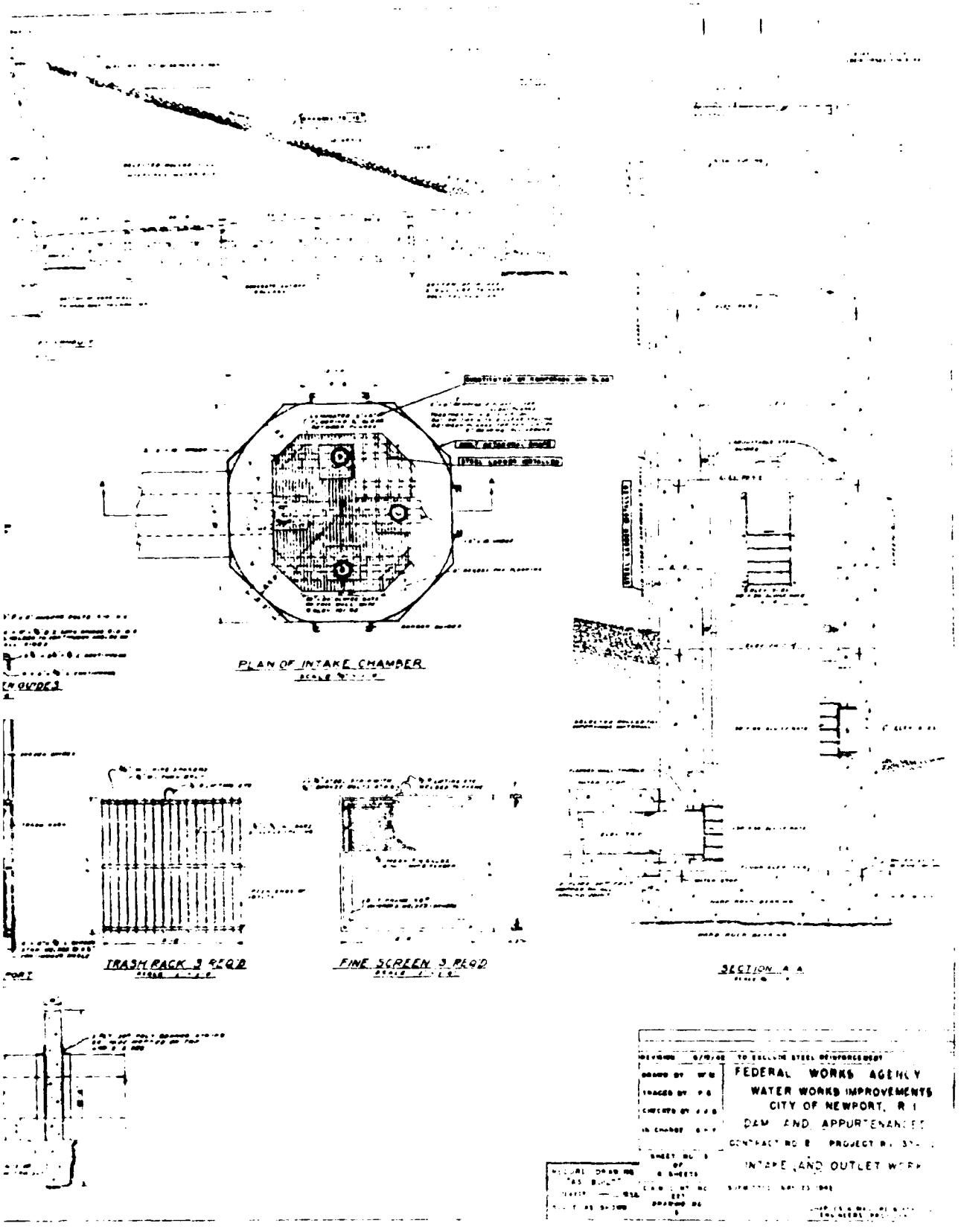

DR #3

1 of 2






KR #5



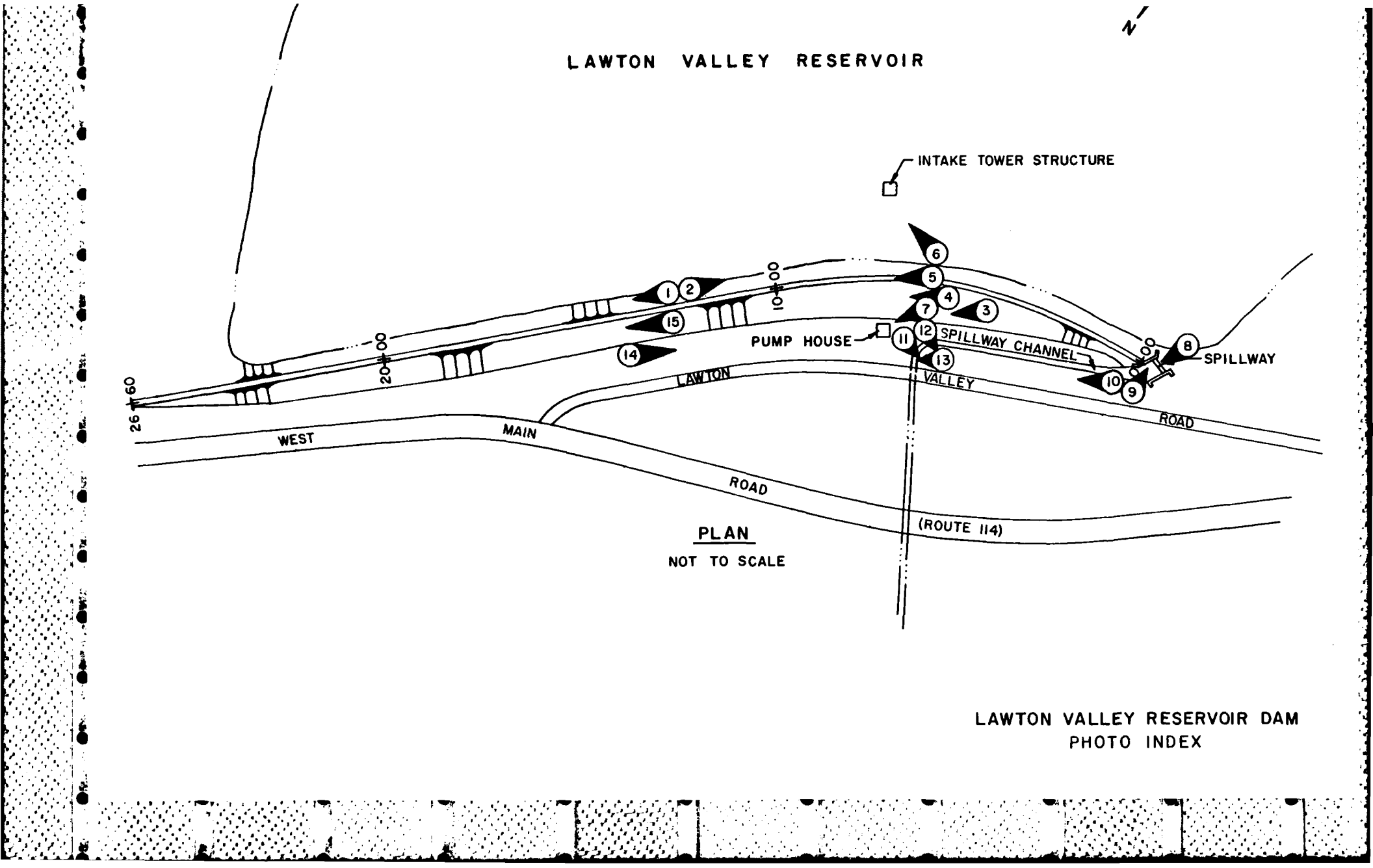

THERE IS NO DR.#4

2 of 2

2 of 2

# APPENDIX C

PHOTOGRAPHS



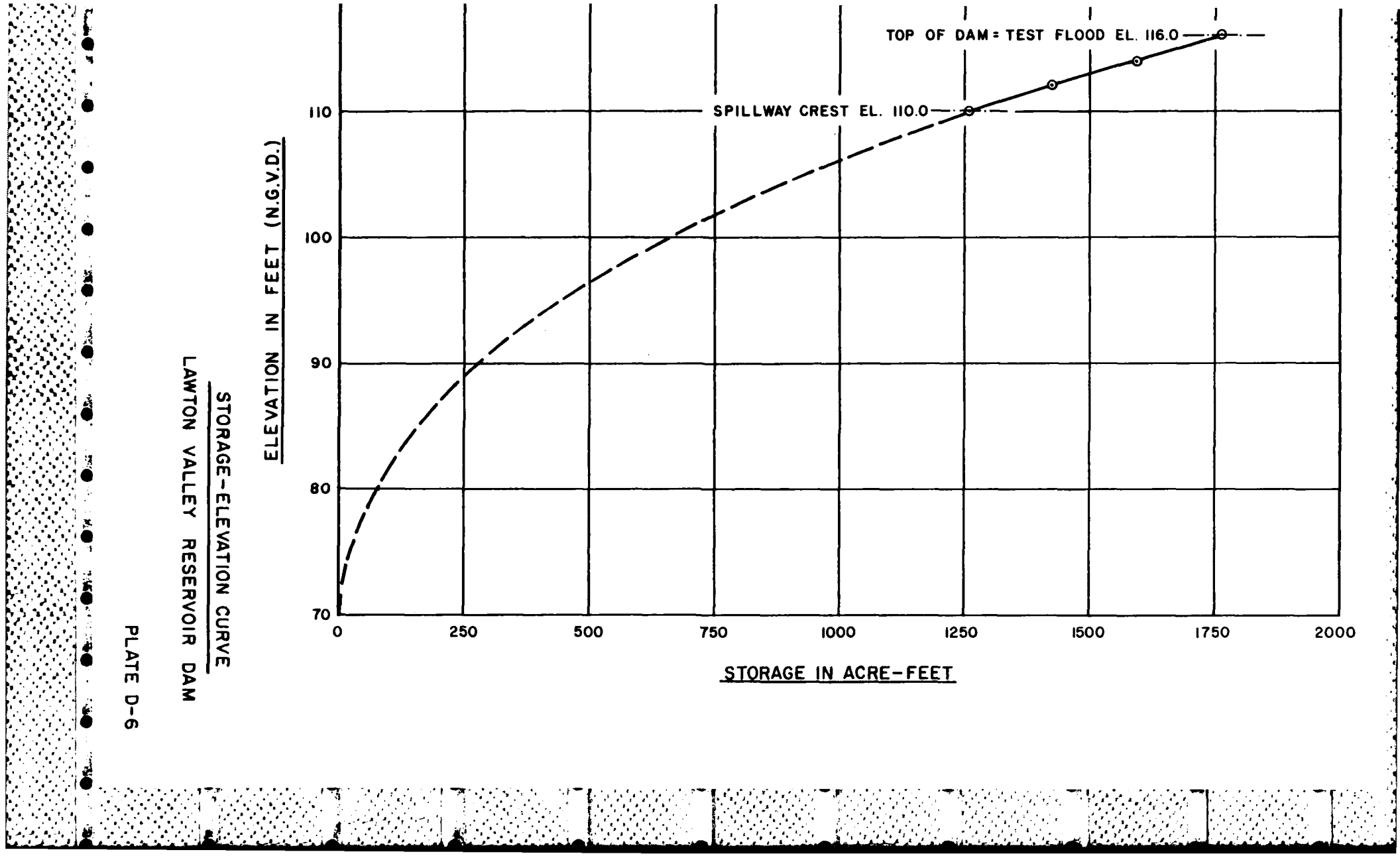

PLAN

NOT TO SCALE

LAWTON VALLEY RESERVOIR DAM
PHOTO INDEX

PHOTO C-1 Upstream face of dam looking toward right abutment.

PHOTO C-2 Upstream face of dam looking toward left abutment.




STORAGE-ELEVATION CURVE

LAWTON VALLEY RESERVOIR DAM

PLATE D-6

"Rule of Thumb Guidance for Estimating Downstream Dam Failure Discharge"

BASIC DATA

n Lawton Valley Reservoir Dam Name of town Portsmouth, R.I.

rea = 2.88 sq. mi., Top of dam 116.0 NGVD

ype = overflow - ogee weir Crest of spillway 110.0 NGVD

ea at crest elevation = 84 acres = 0.131 sq. mi.

bottom near dam = 71.0NGVD

de slopes of embankments 2:1

reservoir at dam site 45 = $y_o$ = 45 ft.

elevation of dam = 93.0 NGVD

dam at crest = 2580 ft.

dam at mid-height = 2400 ft.

n length at mid-height = $W_b$ = 120 ft.

channel immediately downstream = B = 120 ft.; Shape of Breach = rectangular

| ation (NGVD) | Estimated Storage in AC-FT | |
|---|---|---|
| 110.0 | 1260 | Spillway Crest |
| 112.0 | 1428 | |
| 114.0 | 1596 | |
| 116.0 | 1764 | Top of Dam = Test Flood |

Dam: Lawton Valley Reservoir Dam

ng Effect of Surcharge Storage on "Test Flood"
of Flood Through Reservoir]

ing of floods through the reservoir was carried out according to
les established by the Corps of Engineers in Phase-1 Dam Safety
gations issued March, 1978.

s used were the following for peak inflow = $Q_{p1}$ in C.F.S.

harge height to pass $Q_{p1}$ in feet = $h_1 = \left[\frac{Q_{p1}}{CB}\right]^{2/3}$ ----------(1)

harge storage in inches for surcharge height $h_1 = S_1 = \frac{S.A \times h_1 \times 12}{D.A}$ ---(2)
= S.A = surface area in square miles
= D.A = drainage area in square miles

$= Q_{p1}\left[1 - \frac{S_1}{\text{Total Effective Rainfall}}\right]$ ----------(3)

pproximation

flood inflow = Full PMF = $Q_{p1}$ = 2450 C.F.S.

$h_1$ = 6.10 feet

$S_1$ = 3.30 inches

pproximation

Test flood outflow = $Q_{pfinal}$ = 2000 C.F.S.

$h_{final}$ = 6.00 feet

$S_{final}$ = 3.28 inches

final approximation, equations (1), (2) and (3) are satisfied by trial
or with total effective rainfall equal to 19.0 inches.

Watershed Characterization Moderate slope; coastal with natural storages ; 0.30sq. miles is swampy or occupied by storage reservoirs

Adopted "test" flood = Full PMF = 850 CSM = 2450 CFS; Re = Effective Rainfall = 19.5 inches

D.A. = Drainage Area (Gross) = 2.88 Square Miles; Basin Slope = 0.03 - 0.04 hence; Moderate to flat

S.A. = Surface Area of Reservoir = 0.131 Square Miles; Time of Concentration is more than 80 minutes minutes

Shape and Type of Spillway = overflow - ogee weir - concrete crest

B = Width of Spillway = 40 feet; C = Coefficient of Discharge = (3.50 - Friction) = 3.40

Maximum Capacity of Spillway Without Overtopping = 2000 CFS = 100 % of test flood

Top of Dam Elevation = 116.0 ; Spillway Crest Elevation = 110.0

Overflow portion of Length of Dam = 2580 feet ; C = Coefficient of discharge for Dam = 3.0

| Name of Dam | Test Flood $Q_p$ | | Inflow Characteristics | | Outflow Characteristics First Approximation | | | Outflow Characteristics Second Approximation | | | Outflow Characteristics Third Approximation (Adopted) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | CSM | CFS | $h_0$ in feet | $S_0$ in in. | $Q_{p1}$ CFS | $h_1$ in ft. | $S_1$ in in. | $S_2$ in in. | $h_2$ in ft. | $Q_{p2}$ CFS | $S_3$ in in. | $h_3$ in ft. | $Q_{p3}$ CFS |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| Lawton Valley Reservoir Dam | PMF =850 | 2450 | 6.10 | 3.30 | - | - | - | - | - | - | 3.28 | 6.00 | 2000 |
| | ½PMF =425 | 1250 | 4.38 | 2.39 | - | - | - | - | - | - | 2.04 | 3.73 | 981 |

$Q_p$ = Discharge; h= Surcharge height; S = Storage in inches

NOTE: Outflow discharge values are computed as per COE guidelines.

Classification

dam = 33.0 ft.; hence -

pacity at top of dam (elev. 116.0) = 1760 AC-FT.; hence INTERMEDIAT

ze classification INTERMEDIATE

d Potential

Failure of this dam will damage Lawton Valley Road, West Main Road, as well

onRail trackage, public utilities, and a pumping station. Dam failure can

disrupt the water supply to the city of Newport.

ted Classifications

| | SIZE | TEST FLOOD RANGE |
|---|---|---|
| GNIFICANT | INTERMEDIATE | Half PMF to Full PMF |

est Flood = Full PMF = 850 CSM

= 2450 CFS

topping Potential

nage Area = 2.88 sq. miles

lway crest elevation = 110.0 NGVD

of Dam Elevation = 116.0 NGVD

pillway discharge
without overtopping of dam = 2000 CFS

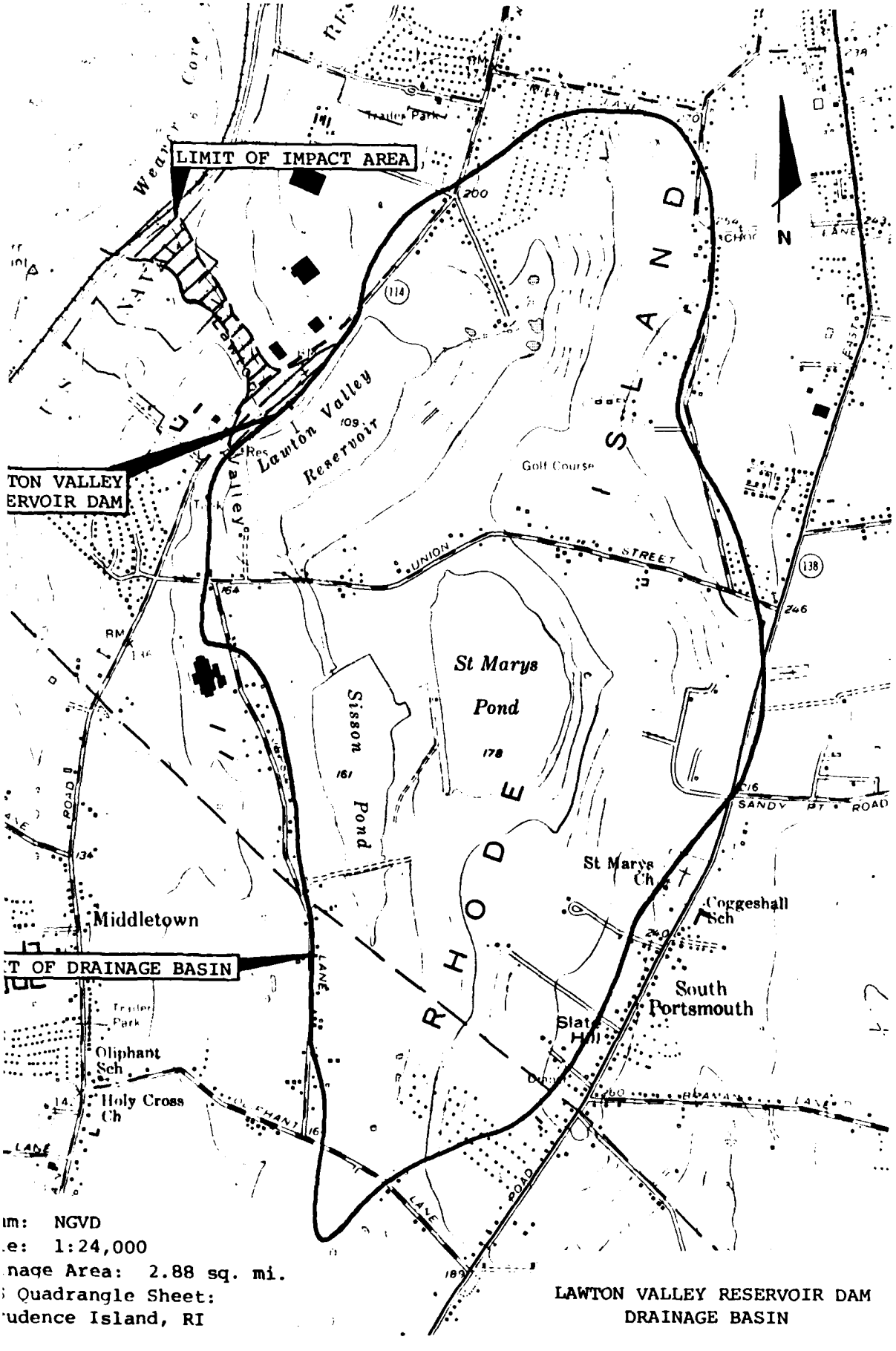
od" inflow discharge = 2450 CFS

od" outflow discharge = 2000 CFS

t flood" overflow carried
ay without overtopping = 100%

od" outflow discharge portion
rflows over the dam = 0

flood which overflows over the dam = 0%




im: NGVD
.e: 1:24,000
nage Area: 2.88 sq. mi.
Quadrangle Sheet:
udence Island, RI

LAWTON VALLEY RESERVOIR DAM
DRAINAGE BASIN

PLATE D-1

# APPENDIX D

## HYDROLOGIC AND HYDRAULIC COMPUTATIONS

PHOTO C-15 Typical seepage emerging along downstream toe of dam.

PHOTO C-13 Spalled and eroded concrete of chute spillway (Note seepage running along slab).

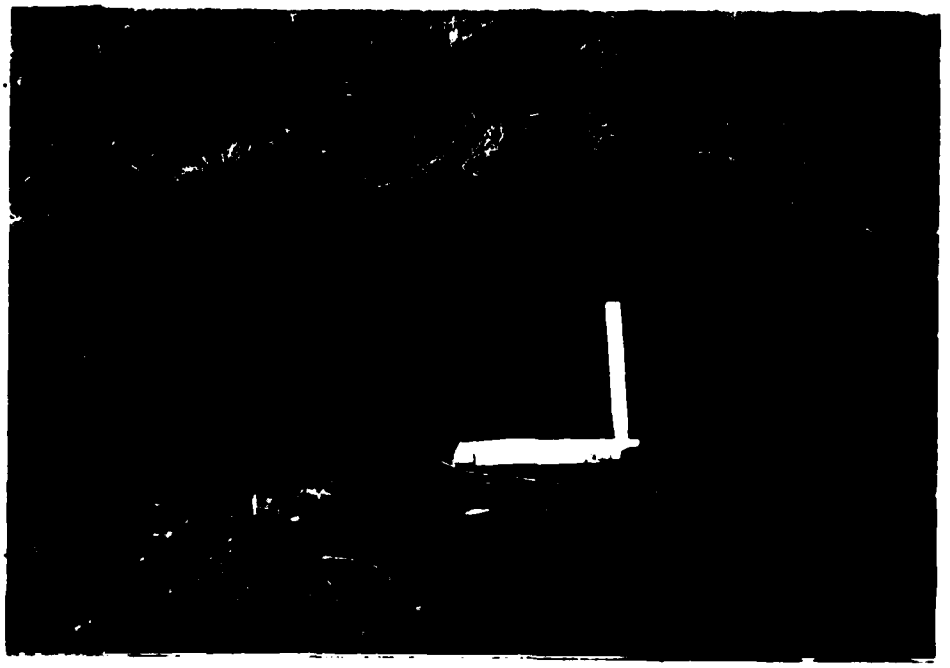


PHOTO C-14 Animal burrow in embankment of dam.

PHOTO C-11 Box culvert at downstream end of spillway chute.

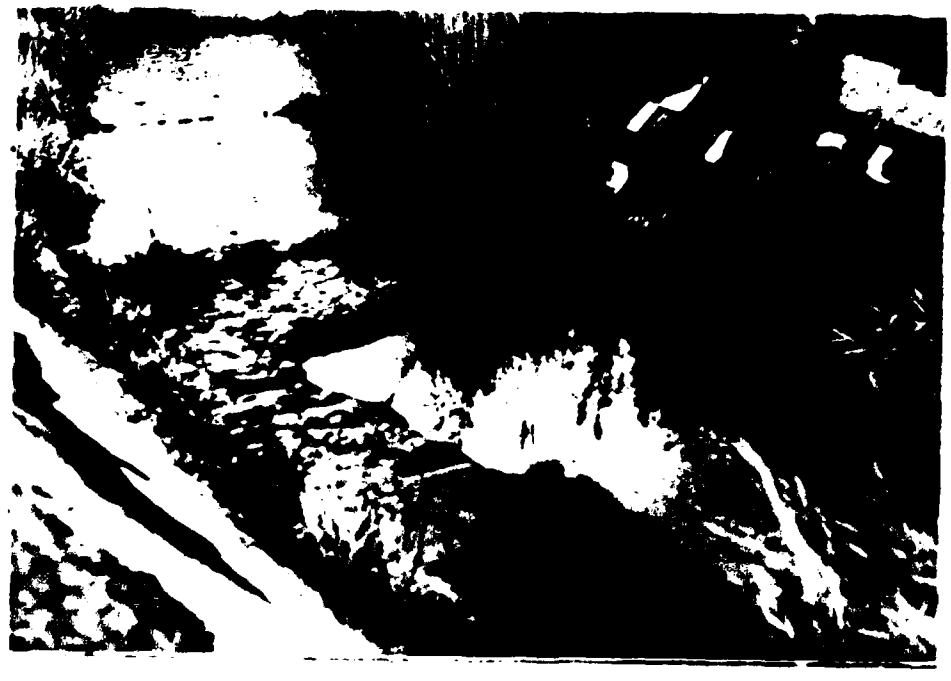


PHOTO C-12 Spalled and eroded concrete walls and slab of spillway chute (Seepage through joints).

PHOTO C-9 Overflow spillway weir (Note service bridge removed).

PHOTO C-10 Spillway chute.

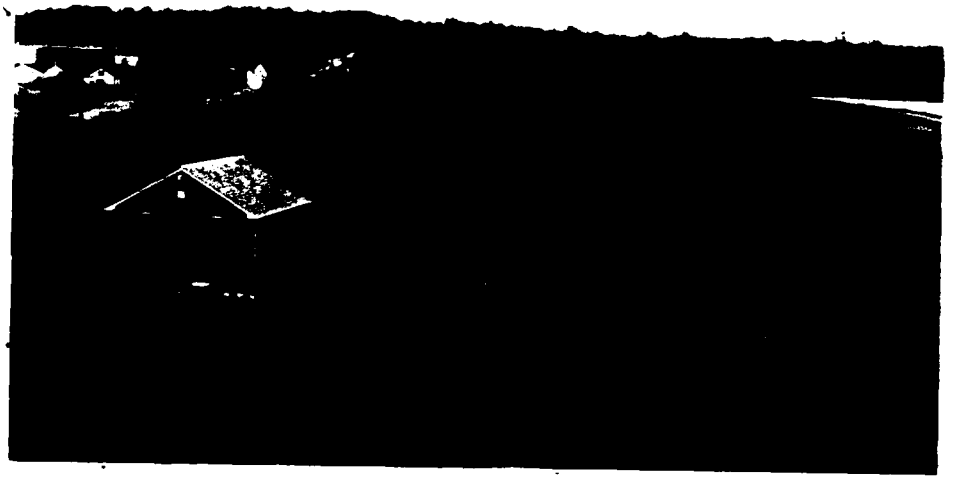
PHOTO C-7 Outlet chamber (foregound); pump house (background).

PHOTO C-8 Overflow spillway approach.

PHOTO C-5 Crest of dam looking toward right abutment.

PHOTO C-6 Intake chamber and control tower.

. PHOTO C-3 Downstream slope of dam looking from left abutment.



. PHOTO C-4 Downstream slope of dam (Pumping Station in left foreground).

Lawton Valley Reservoir Dam

DAM FAILURE ANALYSIS

In addition to energy considerations, the volume of water which is available in the reservoir to sustain the flood wave must be considered. Important energy losses which occur as the flood wave moves downstream include friction losses, bend losses, obstruction losses, expansion and contraction losses, etc. Also the failure discharge and energy losses are reduced by the failure hydrograph being modified with decreasing peak due to available storages downstream. Judgment was used to estimate the most critical situation after the dam failure. Consequently analysis was based upon i) undular wave rather than hydraulic bore; ii) impact of flood wave and the resulting energy loss due to damaged or destroyed structures and sinuosity of the channel were ignored; and iii) the dam failure discharge of 60856 C.F.S. will merge with 2000 C.F.S. already flowing through the existing overflow spillway making a total outflow of 62856 C.F.S. It is assumed that prior to failure, the maximum spillway discharge has already substantially filled the available storage areas downstream. In this case large storage areas are not available and no adjustment of outflow discharge is required. At a distance of 800 feet downstream the West Main Road _____ obstruction will not allow this large discharge to go through and ponding against this obstruction will convert its wave and kinetic energy back into pressure energy and flow changing to steady and uniform flow further downstream with 6.0 ft. depth following Manning's formula.

NOTE: --

1. Adopted water surface elevation is higher of the two values:
   a) ground elevation + $\frac{4}{9} y_o$ - drop in depth

   OR b) ground elevation + $d_n$
2. There are three depths for different characteristics of flow.
   a) Depth of flow immediately downstream of dam for unsteady flow conditions = $\frac{4}{9} y_o$ = 20.0 feet
   b) Normal depth for $Q = Q_{b_1} + Q_S$ value of discharge = $d_n$ = 20.0 feet
   c) Normal depth for $Q_S = d_n^1$ = 6.0 feet
3. Maximum depth is greater of $\frac{4}{9} y_o$ or $d_n$ = 20.0 feet
   Maximum velocity of flow = $\frac{4}{3}\sqrt{gy_o}$ = 50.7 ft./sec.
   Increase in depth due to failure = ($d_n$ or $\frac{4}{9} y_o$) - $d^1 n$ = 14.0 feet

DAM FAILURE ANALYSIS

NOTES:

1. $W_B \leq B$
2. Failure of dam is assumed to be instantaneous when pool reaches top of dam, and is a full depth - partial width rectangular shaped failure.

STEP 1 - Dam Failure Discharge = $Q_b$

$$Q_b = \frac{8}{27} W_B \sqrt{g}\ y_o^{3/2} \left(\frac{B}{W_B}\right)^{0.25*} = 1.68\ B^{0.25}\ W_B^{0.75}\ y_o^{1.5}$$

$$= 60856 \text{ C.F.S.}$$

* Reference: Research note No. 5, "Guidelines for Calculating and Routing a Dam - Break Flood by the Hydrologic Engineering Center - C.O.E. - January, 1977.

Maximum Spillway Discharge = $Q_S$ = 2000 C.F.S.

(C = 3.40 B = 40 H = 6.0 ft.)

STEP 2 - Wave Flow (Unsteady Flow) Characteristics

Depth of flow immediately downstream of Dam = $\frac{4}{9} y_o$ = 20.0 ft.

Velocity of flow immediately downstream of Dam = $\frac{2}{3} \sqrt{g y_o}$

= 25.38 ft./sec.

STEP 3 - Adopted minimum possible wave depth of flow = 0.138 $y_o$ = 6.21 ft.

Actual maximum possible velocity of flow = $2 \sqrt{g y_o}$ = 76.13 ft./sec.

Adopted theoretical maximum possible velocity = $\frac{2}{3}\ 2 \sqrt{g y_o}$ = 50.7 ft./sec.

STEP 4 - Normal Flow (typical) Manning's Characteristics

Location of unwashable major obstruction is Route 114

800 ft. D/S

$S_o$ = 0.002 ; "n" = 0.05 ; Bed width of channel = b = varies

Total failure discharge = $Q = Q_b + Q_S$ = 62856 C.F.S.

Normal depth of flow for Q (62856 C.F.S.) = 20.0 feet = $d_n$

Normal depth of flow for Q ( 2000 C.F.S.) = 6.0 feet = $d_n^1$

Adopted maximum depth is larger of $\frac{4}{9} y_o$ or $d_n$ = 20.0 feet

Adopted increase in depth due to failure of dam ($\frac{4}{9} y_o$ or $d_n$) - $d_n^1$ = 14.0 feet

Adopted maximum velocity of flow = $\frac{4}{3} \sqrt{g y_o}$ = 50.7 ft./sec.

DAM FAILURE ANALYSIS

STEP 5 -

Anticipated adopted minimum wave depth of flow = $d_{minimum}$
= 0.17 $y_o$ feet = 7.65 feet

Parabolic shaped water surface profile from the dam upto obstruction presumably unwashable 800 ft. ($x_{total}$) ft. downstream is computed by and adjusted for possible steady and normal flow depth backup in the below given table.

$$(\frac{4}{9} y_o - d_{min.}) (\frac{x}{x_{total}})^2 = 0.28\ y_o (\frac{x}{x_{total}})^2 \text{ where } x_{total} = 800 \text{ ft.}$$

| Distance from center line of dam = x | $(\frac{x}{x_{total}})^2$ | Drop in depth | Water Surface Elevation as Unsteady Flow | Ground Elevation | Normal Depth | Adopted Water Surface Elevation |
|---|---|---|---|---|---|---|
| 0 | 0 | 0 | 116.0= Top of dam | -- | | 116.0 =Top of dam |
| 0 | 0 | $\frac{5}{9} y_o$ = 25 ft. | 91.0 Adopt 94.0 | | $d_n$ | 91.0 = just D/S of dam Adopt 94.0 |
| 100 | .0156 | 0.20 | 93.8 | 74.0 | 20.0 | 94.0 |
| 200 | .0625 | 0.79 | 93.0 | 73.8 | 20.0 | 93.8 |
| 300 | .1406 | 1.77 | 92.0 | 73.7 | 20.0 | 93.7 |
| 400 | .25 | 3.15 | 90.4 | 73.6 | 20.0 | 93.6 |
| 500 | .3906 | 4.92 | 88.4 | 73.3 | 20.0 | 93.3 |
| 600 | .5625 | 7.09 | 85.9 | 73.0 | 20.0 | 93.0 |
| 700 | .7656 | 9.60 | 83.1 | 72.7 | 20.0 | 92.7 |
| 800 | 1.0000 | 12.60 | 79.4 | 72.4 | 20.0 | 92.4 |

Note: Adopted water surface elevation is higher of the two values:

a) Ground Elevation + $\frac{4}{9} y_o$ = drop in depth

OR b) Ground Elevation + $d_n$

Lawton Valley Reservoir Dam

COMPUTATIONS FOR
SPILLWAY RATING CURVE AND
OUTLET RATING CURVE COMPUTATIONS

Spillway width = 40 feet; Spillway crest elevation = 110.0 NGVD

Length of dam = 2580 feet; Top of dam elevation = 116.0 NGVD

C = 3.40 (overflow - ogee weir with sloping upstream apron)

i) SPILLWAY RATING CURVE COMPUTATIONS

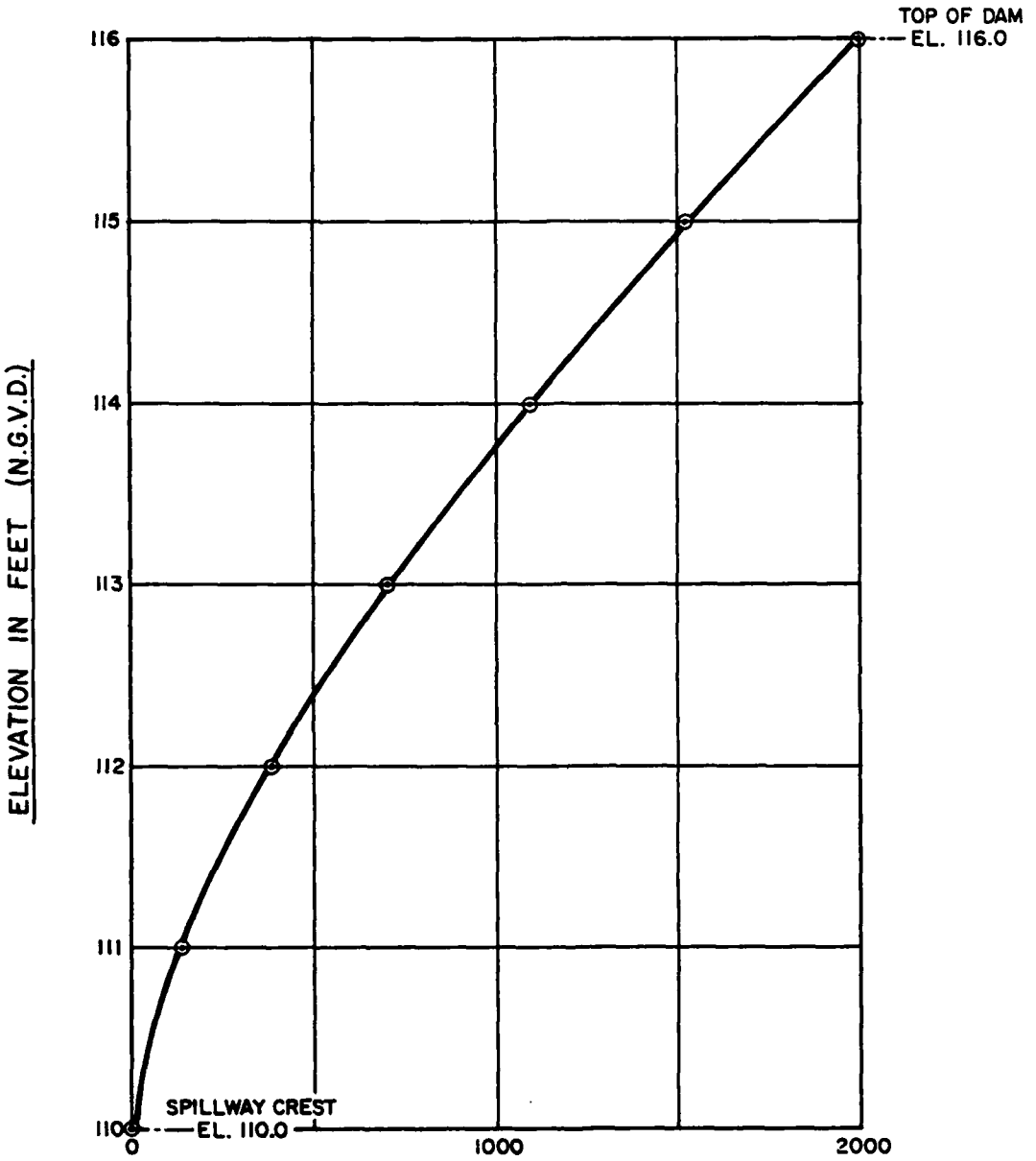
| Elevation (ft.) NGVD | Spillway Discharge (CFS) | Remarks |
|---|---|---|
| 110 | 0 | Spillway Crest |
| 111 | 136 | |
| 112 | 385 | |
| 113 | 706 | |
| 114 | 1088 | |
| 115 | 1520 | |
| 116 | 2000 | Top of Dam = Test Flood |

ii) OUTLET RATING CURVE COMPUTATIONS

| Elevation (ft.) NGVD | Discharge (CFS) | Remarks |
|---|---|---|
| 116.0 | 60 | Top of Dam = Test Flood |
| 114.0 | 58 | |
| 112.0 | 57 | |
| 110.0 | 56 (55.5) | Spillway Crest |
| 104.0 | 51 | |
| 100.0 | 47.6 | |
| 96.0 | 44 | |
| 90.0 | 38 | |
| 80.0 | 25.5 | |
| 71.0 | 0 | Invert of Outlet |

Size of outlet = 18"diameter pipe; Area of outlet = 1.755 sq. ft.

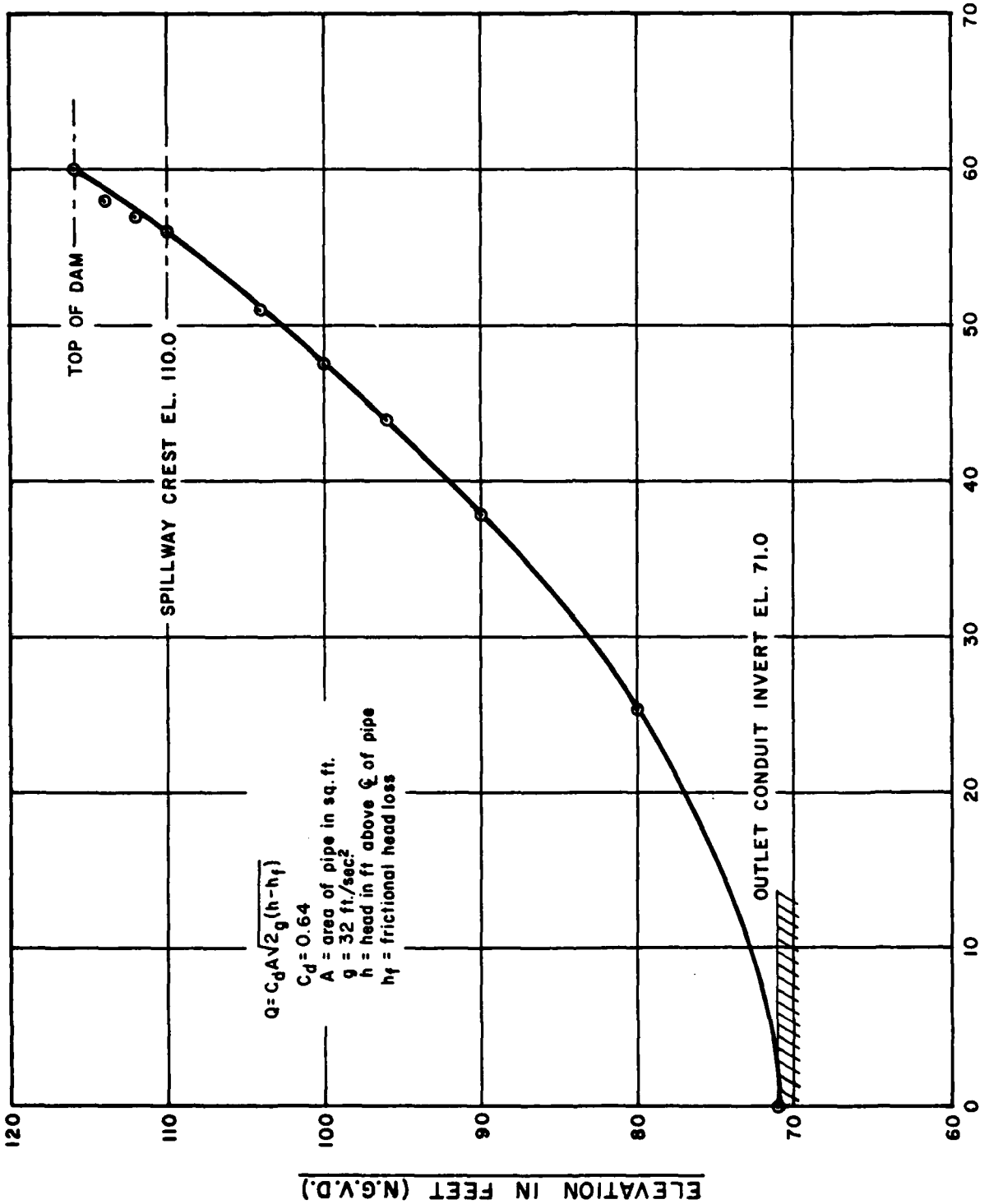
Invert of outlet = 71.0; Center line of outlet = 71.75




SPILLWAY RATING CURVE

LAWTON VALLEY RESERVOIR DAM

PLATE D-11




OUTLET WORKS RATING CURVE

LAWTON VALLEY RESERVOIR DAM

PLATE D-12

# APPENDIX E

## INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

NOT AVAILABLE AT THIS TIME

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